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NOTES ON THE COCHINEAL INSECT.

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The following notes have been put together in the hope that they may tend towards a better understanding of the genus *Coccus*, as now restricted. Notwithstanding the voluminous literature on the subject of cochineal, it cannot be said that the insect producing this substance is adequately known to entomologists, or that the affinities of the genus in which it is placed are altogether well understood.

At the outset we have to inquire, what is *Coccus cacti?* According to Watt (Dict. Econ. Prod. India, Vol. II), it was discovered by the Spaniards in Mexico in 1518, but was not made known in Europe until 1523. The name *Coccus cacti* seems to have been applied to it as early as 1651 by Hernandez, but of course the species is now credited to Linné.

Coccus cacti Linné, as understood by its author, is simply the cochineal-producing insect found on cacti in Mexico. It need hardly be said that minute details, such as are now considered of generic and specific importance in the Coccidæ, were not taken into account in the definition of the species.

In the present century, however, it began to be suspected that there was more than one species. Signoret, writing about twenty years ago, mentions three segregates from the old *C. cacti*, namely, *C. tomentosus* Lam., *C. bassi* Targ., and *C. sylvestre* Thierry de Meronville. These, he says, are supposed species,

based on specimens from Mexico, presenting differences in color and the amount of cottony matter.

In the same work (Essai sur les Cochenilles) Signoret gives a definition of *C. cacti* which may be taken as fixing the strict application of the name. Properly, therefore, the insect is *Coccus cacti* L., sens. Sign., and its principal characters are as follows:

Female. Dark red-brown, 6 to 7 mm. long, 4 wide, 2 to 3 high, with a great quantity of white cottony matter. Segmentation distinct. Back more or less keeled. Antennæ short, conical, 7-jointed, the four basal joints short, wider than long; joint 7 as long as the two before it together. Larva with 6-jointed antennæ.

Male. Red-yellow, legs and antennæ brown. Antennæ 10-jointed, hairs on antenna knobbed.

In Ashmead's Generic Synopsis of the Coccidæ, the genus *Coccus* forms a tribe Coccini, distinguished from the tribe Acanthococcini by no very tangible characters. It is stated that the male is apparently without ocelli (see however, Signoret's figure) and the adult ♀ lacks the bristles on the anal ring. Maskell (New Zealand Scale Insects) had earlier placed *Coccus* in a subdivision by itself, defined thus: "Adult females active, covered with mealy secretion; antennæ of seven joints; no hairs on anogenital ring. Eyes of male not facetted."

The question as to there being two or more species, after being answered in the negative by Signoret, was again raised in 1884 by Lichtenstein. This entomologist had received specimens from Mexico which he considered to be the *Coccus tomentosus* Lam.; but he not only regarded this species as distinct from *cacti*, but transferred it to *Acanthococcus*—a genus known hitherto only from Europe and New Zealand.

The nomenclature of the Cochineal insects, according to the latest researches, is, therefore:

Tribe COCCINI. Genus COCCUS L., Sign.

COCCUS CACTI L., Sign.

Tribe ACANTHOCOCCINI. Genus ACANTHOCOCCUS Sign.

ACANTHOCOCCUS TOMENTOSUS (Lam.) Licht.

So the genus *Coccus* would still remain monotypic, were it

not that in 1888 Mr. Douglas described a *Coccus agavium*, found on *Agave*—not a cochineal insect. It is true that the recent literature contains some other nominal species of *Coccus*, such as *C. laniger* W. F. Kirby, 1891, but in so placing them, their authors have reverted to the Linnean use of the term, ignoring genera as now defined.

From an examination of cochineal insects from Jamaica, Mexico, and New Mexico, I have come to the conclusion that the above-mentioned definition and classification need entire revision. This conclusion may be wrong, and was only reached with much hesitation—but it seems sufficiently clear after considering all the evidence.

The specimens examined are:

1. From the Parade Garden, Kingston, Jamaica, on *Opuntia*: =*Coccus cacti* L.

2. From Silao, Mexico, on *Opuntia tuna*, from Dr. A. Dugès: =*Coccus tomentosus* Lam.

3. From Guanajuato, Mexico, from Dr. A. Dugès:=*Coccus tomentosus* Lam.

4. From Las Cruces, New Mexico:=*Coccus confusus* n. sp.

The Silao insect is Lichtenstein's *Acanthococcus;* there can be no doubt about this as Lichtenstein had his specimens from Dr. Dugès, who assures me they are the same. All the others, however, are strictly congeneric with this, and therefore either *Acanthococcus tomentosus* is a *Coccus*, or all belong to *Acanthococcus.*

Acanthococcus, as stated above, has been recorded from Europe and New Zealand. Maskell sinks the genus as a synonym of *Eriococcus*, which he defines thus:

"Adult female enclosed in an elongated sac of white or yellow felted cotton; body elongated, segmented; anal tubercles conspicuous; feet and antennæ present; several rows of conical spines on dorsal surface. Antennæ of six joints." The anogenital ring is also said to have hairs.

This does not precisely agree with *C. tomentosus*, but on comparing that insect with the published descriptions of *Eriococcus* spp., the affinity is evident.

The Jamaican specimens agree very closely with *Coccus cacti*,

but are certainly of the same genus as *tomentosus*. If they are not *C. cacti*, they represent a new species exceedingly like it—a view of the case which seems wholly untenable.

The conclusion, therefore, at which I arrive is that *Coccus*, as typified by *C. cacti*, is a genus very near to *Eriococcus*, and not by any means to be separated as a different tribe. Also, that the cochineal insect includes three or more closely allied species or races. It will be useful to consider the characters in detail.

COCCUS L., Sign.

Adult Female.

Size.—*Coccus cacti*, according to Signoret, is from 6 to 7 mm. long. *C. tomentosus*, from Guanajuato, varies from 3½ to nearly 5 mm. in length.

Shape.—The species are broadly oval; the keel seen by Signoret is more due to shrinkage in drying than anything else. *C. tomentosus* may be described as hemispherical, with the hind end a little pointed.

Color.—All give the characteristic cochineal color, and so far as this is concerned, I see little difference. *C. tomentosus* placed in caustic soda without heating, gives a beautiful reddish-violet color; on boiling, this turns bright crimson. This was observed in Guanajuato specimens; of Silao examples I noted that heated in caustic soda they gave a magenta color, very strong, which, by transmitted light, was bright violet, like log-wood staining.

C. confusus, boiled in soda, gave a very fine, bright carmine.

The under surface of *C. tomentosus*, where free from secretion, appears dark purplish in the living insect. Signoret says *C. cacti* is dark red-brown; those from Jamaica are better described as dark greyish. In Ency. Brit., 9th Ed. (1877), the ♀ of *cacti* is described as dark brown. *C. cacti* has been introduced in Madeira, and I found it there on *Opuntia* in 1879. I have a water-color drawing made of it at the time, and it is represented as dark bluish-gray, not at all reddish.

Secretion. The secretion is better described as cottony than mealy. As noticed by Signoret, it differs in the several races,

and these differences cannot be held to have generic value. In *C. confusus* and the Jamaican *C. cacti*, the secretion is profuse, so that the individuals are hidden in it, and separated with difficulty. In the Madeira *C. cacti*, it is much more sparse, allowing the gray color of the females to be seen. In *C. tomentosus* it forms a sac covering the insect, after the manner of *Eriococcus;* in the smaller specimens, part of the body below is free, but larger ones are entirely covered by secretion. The individuals of *C. tomentosus* in their woolly sacs, are easily separable from one another.

Activity.—Maskell writes for *Coccus*, "adult female active;" as against the stationary females of *Eriococcus*, etc. This supposed character is valueless; the final state of female *Coccus* is one of inactivity.

Antennæ.—The antennæ are very small, and show plain evidence of degeneration. In *C. cacti* from Jamaica I could plainly see the seven joints; the first large, the second broad and very short, the third longer but still broader than long, the fourth perhaps as long as the third but not so broad, the fifth and sixth about as broad as long, and the seventh decidedly longer than broad, rounded, emitting two or more hairs. All this agrees excellently with Signoret's *cacti*.

C. tomentosus also shows seven joints, practically as in *cacti*, except that the fourth joint is longer in proportion. *C. confusus* has the antennæ more degenerated, five-jointed, all the joints broader than long except the last; third shortest, last emitting about seven hairs.

Legs.—In *C. confusus* I found all the legs present and well-developed, though small. Femur about as long as tarsus and tibia; tibia decidedly *shorter* than tarsus. In *C. tomentosus* the legs are stouter than in *confusus*, the tibia about as long as the tarsus, but if any difference, the tibia is the shorter. Femur very stout, and about as long as tarsus and tibia. The tibia is broader than the tarsus; the claws large. The usual knobbed hairs at end of tarsus are present.

Truncate Spines.—The skin of all three species shows numerous truncate processes, which no doubt represent the spines of the larva and of the species of *Eriococcus*. These processes

consist of two parts, a broad ring-like basal part, and a cylindrical sharply truncate terminal part. In *C. confusus* these processes are decidedly more slender than in *C. tomentosus,* the latter being characterized by their great thickness. In *C. cacti* from Jamaica they are also thick, practically as in *tomentosus.*

Grouped Orifices.—Little groups of glands, like those of the Diaspinæ, are seen among the spines. These groups are compact and very clearly circumscribed, and are quite obvious in *C. cacti* (Jamaica) and *C. confusus.* In the latter, some groups are of three orifices only, but usually there are many, perhaps averaging about 15.

Viviparous Habit.—*C. confusus* was found to have the body full of well-formed larvæ. *C. tomentosus,* from Silao, which had been long in alcohol, were full of larvæ.

Immature Stages.

Color.—The young of *C. tomentosus* are reddish-purple.

Antennæ.—I found 7 joints in the second stage of Jamaican *C. cacti.* In *C. confusus* there *seem* to be 7 joints in the larva, but two are, perhaps, to be considered false joints; these are in joints 1 and 3. The second, first and fifth (or last) are about equal, the third and fourth shortest. The last four joints emit hairs, one on the fifth being especially long. The antennæ of *C. confusus* appear to degenerate with the growth of the insect.

In the larva of *C. tomentosus,* I found the antennæ 5-jointed, the proportions of the joints as in *Confusus.* The false joint in joint 1 is noticed, but it is evidently not a true joint. Joints 3 and 4 have a peculiar shape, concave on one side, convex on the other. The last joint has four hairs, two of which are long.

The larva of *Coccus* is commonly said to have 6-jointed antennæ. According to Signoret's figures, that of the ♀ has 6 joints, that of ♂ only 5.

Legs.—The legs are, of course, much better developed in the larva than the adult, in proportion to the size of the insect. In the leg of a larva of *C. confusus,* I noticed two strong bris-

tles on the inner side of tarsus, and one at distal end of tibia. Tibia shorter than tarsus, but not so much so as in the adult, thus reversing the usual order of events.

In *C. tomentosus* I noted, legs of larva with long claws, and longer tarsal hairs, tibia shorter than tarsus. In Jamaican *C. cacti*, second stage, I noticed the length of the claws.

Rostral Filaments.—In the very young larvæ of *C. confusus* and *C. tomentosus*, the rostral filaments are coiled like the spring of a watch, and very conspicuous.

Anogenital Ring.—The absence of hairs on the anogenital ring is given as a generic character of *Coccus;* but these hairs, about six in number, were plainly seen in the second stage of Jamaican *C. cacti.*

Spines.—All three species have in the larva distinct rows of spines, which run longitudinally down the back, just as Signoret figures for *Capulinia sallei.* In *C. tomentosus* I found two parallel dorsal rows, and two rows on each side of the anterior part of the body, joining to form one row on the posterior half. These spines have sharp points, differently from the truncate processes of the adult.

Male Sac.—In *C. tomentosus*, this is white, elongated, about $1\frac{1}{2}$ mm. long. In Jamaican *C. cacti* it is quite similar.

Adult Male.

Size.—In *C. tomentosus* the body is about 1 mm. long.

Color.—The male of *C. cacti* is said to be red-yellow (Signoret) or deep red (Ency. Brit., 9th Ed.). A male of Jamaican *C. cacti*, after being boiled in soda, showed the thorax and genitalia pale brownish, the abdomen pink. In a male not so treated, the wings were observed to be white, appearing granulose, about half their length extending beyond the body.

In a living male of *C. tomentosus*, the body was dark purple-red, the wings whitish subhyaline, the veins not colored. Crushed under a cover-glass, the body gave a brilliant magenta color.

Caudal Filaments.—The abdomen of *C. cacti* from Jamaica emits two very long filaments. *C. tomentosus* also shows a pair of long white filaments.

Antennæ.—These are 10-jointed, as observed in Jamaican *C. cacti*, and *C. tomentosus*. The two first joints are comparatively short. I noted of *C. tomentosus:* joint 2 subglobose, 3 longest, fusiform; 4, 5 and 6 fusiform, equal, distinctly shorter than 3; 7 *slightly* shorter than 6; 7, 8, and 9 subequal; 10 about as long as 4. Joints with whorls of hairs. Antennæ dark reddish, but last joint pale pink. The Jamaican *C. cacti* showed about the same, but 4 longer than 5. I saw no knobbed hairs.

Signoret says the antennæ of *cacti* are brown, and in his figure the fourth and fifth joints are longer, if anything, than the third.

Legs.—I noted of *C. tomentosus:* claw long and straight; digitules very slender, filiform, hardly knobbed. Tarsal knobbed hairs well-formed, rather stout. Tibia and tarsus with a row of strong short spines on inner side. Tarsus about two-thirds length of tibia; tibia a little shorter than femur; trochanter with a long hair.

Scutellum.—The scutellum in Jamaican *C. cacti* exhibits a distinct median longitudinal furrow.

Conclusions.

1. Pending the discovery of new facts proving otherwise, I would propose to unite the tribes Acanthococcini and Coccini under the latter name.

2. The genus *Coccus* may be re-defined as consisting of species which have rows of dorsal spines in the larva, truncate dermal processes in the adult female, antennæ 7- or 5-jointed in the ♀, 10-jointed in the ♂, 5- or 6-jointed in the larva, and in the ♀ more or less abundant cottony secretion. The absence of bristles on the anogenital ring of the adult ♀ may also be cited; it was on this ground that Dr. Riley, to whom I sent *C. tomentosus*, objected to its inclusion in *Acanthococcus*, the latter genus having the bristles.

3. The cochineal insect, as commonly understood, may be taken to include three closely allied species, *C. tomentosus* Lam., *C. cacti* Linn., *C. confusus* Ckll., separated by the characters given above. Former records of the occurrence of *C. cacti*

must be held more or less doubtful until specimens are re-examined.

4. *Coccus* may be held to include only the cochineal insects. *Coccus* (*Gymnococcus* Dougl.) *agavium* seems ~~seems~~ to belong to a separate genus, and may be known as *Gymnococcus agavium.*

5. *Capulinia* seems to be a very closely allied, but still more degenerate genus.

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BACTERIOLOGY IN ITS GENERAL RELATIONS.[1]

By H. L. Russell.

(*Continued from page 859.*)

Quite naturally, the practical application of bacterial research has been primarily directed along the lines of medicine and the industrial activities. In any new branch of scientific progress, this is almost invariably the case. Our interest in the subject is largely measured by what it is worth to us, and in proportion as it fills this function do we estimate the importance of its study. The results that have already been accomplished in bacteriology have not however been entirely confined to the applied side of the subject. The cause of pure science has also been greatly advanced in various ways. The correlation of any branch of science with allied subjects is to-day so intimate that any discovery in one, often furnishes valuable suggestions in kindred lines of research. It is in this light that we may consider the effect that bacteriology has had upon the greater subject of biology, taken in the pure not the applied sense, and if possible point out some of the lines which seem to promise a rich fruitage from a general biological standpoint. It can hardly be expected that so young a member of the biological family could as yet have contributed much to the common fund that all its workers are striving to accumulate, yet it may with justice be said that the circle of its influence has widened much beyond its own particular sphere. Perhaps the most valuable of the contributions to its sister branches has been in its *technique*. This influence has been most strongly marked in the closely related departments of botany. The excessive minuteness of bacterial forms and the ubiquity with which these organisms are distributed made it absolutely necessary that some reliable means of pure cultures should be introduced before much real advance could be made in this subject. In bacteriology; this

[1]De'ivered before the Biological Club of the University of Chicago, Feb'y, 1893.

found its greatest development in the employment by Koch, of gelatin as a transparent solid medium for the isolation and cultivation of germs. Some features of this method had been anticipated by other workers, especially Klebs.

This method enables the experimenter to isolate the form he desires to study from any mixture of different species, and by cultivating it in sterile media, a pure culture derived from a single germ can be obtained which is made the basis of definite morphological and physiological study. Brefeld's methods of studying the morphology and developmental history of the fungi are essentially the same as the bacteriological culture methods. He first obtained his pure cultures by dilution until he had a single germ. Later he added the use of gelatine or other transparent ingredients as a means of isolating and fixing the developing organism. The results of these studies which now fill ten large quarto volumes, are among the greatest contributions to mycology, that this century has produced. He refused to admit the validity of the classic descriptions that had been based upon material gathered under natural conditions, maintaining that the systematic part of the science was full of errors, that had arisen from the examination of imperfect mixed growths, and the separation of different growth-forms into individual species.

Basing his opinion upon the only scientific foundation, that we must know the *complete* life history of a form before we can intelligently study its phylogenetic affinities, he made his observations upon pure cultures grown from a single spore in sterile nutrient media. These he kept from the original spore until in many cases the fruiting process had been completed. By this method he was able to settle definitely many disputed points concerning the value of certain form-genera and species. These conclusions of Brefeld, based upon the single cell, pure culture method, have revolutionized the entire classification of the great group of fungi and the theories as to the phylogenetic affinities of different groups have been greatly modified. Hansen adopted the same method in his study of ferment organisms, more especially the yeasts, and this plan of pure culture growths has settled many controver-

sies in the biology of this imperfectly understood group. Beyerinck applied the gelatin method in the isolation of algæ and succeeded in cultivating a number of free unicellular forms, some symbiotic species in certain hydra and paramœcia, and a number of the gonidia in lichens. So far all attempts to apply the isolation methods of solid media to animal life have proven futile. Strenuous efforts have been made upon such parasitic forms as the malaria plasmodium and other parasitic protozoa, but as yet these experiments have not been successful.

With respect to tinctorial methods, bacteriology has been of service. The art of staining to bring out structural differences more clearly has been systematically developed in the latter half of the present century. The discovery of aniline colors in the seventies gave an additional impulse and the names of Koch, Ehrlich, and Weigert will always be associated with the rapid advance and development of this branch of biological technique. The necessity of staining in order to differentiate bacteria in animal tissue has been so imperative, that much time and effort have been expended in order to improve the old, and discover new processes. The success of these efforts has been stimulating in other lines of work, and has materially advanced the general knowledge of stains.

Koch in 1878, was one of the first to apply photography to the study of microscopic preparations. The application of this process by means of photograms for class demonstration, and the obvious advantages that it possesses for accurate illustration are apparent. The recently completed photomicrographic atlas of bacteria by Fränkel and Pfeiffer exemplifies the degree of excellence that has already been attained in this branch.

In the study of bacterial forms, the old types of microscopes were entirely inadequate. The necessity of improved instruments, in regard to definition and resolution to work out the structure of these "infinitely little" organisms, acted as a healthy stimulus on the art and science of lens making. The perfected instrument of to-day, with its homogeneous immersion, the Abbe condenser, and the apochromatic objective, are largely the result of the demand of bacteriologists. These

points suffice to show the influence that the study of the bacteria has exerted upon the technique of other lines of biological thought.

Has it been able to any extent to aid in the solution of any of the general questions that have from time to time engaged the attention of all students of living phenomena? In considering this, reference will be made mainly to those lines that are of special importance in the theoretical problems of biology. As has been previously stated, the main results of bacteriology as yet are found in applied science, but the germ theories of fermentation, of nitrification, of sewage filtration, of nitrogen fixation, of the etiology of contagious diseases and of inflammation are monumental witnesses of the value of this department in the realm of pure science.

Bacterial methods in the hands of the illustrious Pasteur were the means of combatting and effectually routing the heterogenists from their defence and proving beyond the shadow of a doubt, the accuracy and universality of the Harveian motto "*Omne vivum ex vivo.*"

Since the discovery of the laws, which are the foundational basis of the doctrine of evolution, every department of natural science has paid tribute to it, adding fact upon fact, and broadening the basis of the principles, formulated by the observant Darwin. Morphology and physiology in both branches of biology, as well as pathology, have furnished their quota of proof in this grand advance step in knowledge. Has bacteriology contributed its contingent to the general result on this and other vital problems? Does the testimony of the infinitely little corroborate that of the higher and more complex forms of life?

The advantages of this group as types for study on many questions of this nature, have not as yet been generally appreciated. The practical side of the subject has naturally presented the most attractive phase, and even the systematists have found but scant encouragement for their labors, except for the utilitarian purpose of species determination.

The number of observers who have made this group of organisms a subject of special study with reference to general biologi-

cal laws have been but few. Valuable data have however, often been obtained in an incidental way. The possibilities, which this group of organic life offers for the study of many of these general problems, are so noteworthy that it seems worth while to call attention to them more in detail. In selecting forms for the study of certain questions, the biologist chooses, as far as possible, the primitive generalized types upon which to base his observations. Specialization of form and function complicate the conditions and render it more difficult to apprehend the fundamental truth. In this respect bacteria occupy a unique position. Morphologically considered, they are a lowly organized and generalized type, while functionally, they possess a marked degree of specialization.

With our present appliances but little difference can be detected in form between many species that possess widely divergent physiological functions, so that species are often found that are morphologically similar and their dominant physiological function may be expressed either in pigment production, fermentative action, or in an infectious malady.

A certain degree of adaptability in an organism is also necessary if we are to subject it to prolonged experimentation. Many plants and animals are so susceptible to any modification in their surroundings that they cannot well be utilized for purposes of experimentation, a slight change often being sufficient to produce a cessation of the vital functions. Bacteria possess an adaptability not to be found in any other class of organisms. With a large proportion of these forms, the range in temperature of the limits of growth far exceeds any of the higher forms of life.

The majority of species are able to vegetate between 10° C. and 50° C. while exceptional ones grow at the freezing point and others thrive at a temperature of 70° C. This tenacity of life, far surpassing all other forms of animate nature, is as distinctive in the chemical as in the physical environment of these germs.

Another peculiar characteristic, that renders them of especial value from an experimental standpoint, is their rapidity of multiplication. A single cell is the progenitor of millions

in twenty-four hours. We can therefore accumulate the effect of certain external influences upon an almost infinite series of generations within a limited time. The time element, which in higher forms of life often necessitates the extension of experiments over a period of years owing to the relative slowness of reproduction, is here minimized to such an extent as to be brought entirely within the limitations of a single observer. By a rapid successive transference of cultures to fresh media, we can secure the effect of an experiment covering an immense number of generations within a limited space of time. Of course, the absence of sexuality in the reproductive process narrows the sphere of investigation, but there is no valid reason why as valuable results may not be obtained by experimental work on problems of variation and heredity as have been already accomplished with asexually propagated plants, like the sugar cane, banana, and potato. The objection that might be raised, that the morphological and physiological characters are more plastic, and therefore more easily modified than higher specialized forms of life, seems to be answered when we take into consideration the number of generations that intervene between the original type and the establishment of a pronounced variety. The gardener is able to modify the constitution of his plant by cultivating it under special conditions for a few years to such an extent that he produces a horticultural variety in a limited number of generations. The bacteriologist in his "microscopic horticulture" finds it far more difficult to modify his species to the same extent in a limited number of generations.

The ease with which experimental conditions can be modified in the manipulation of bacteria is also a valuable factor. The physical and chemical environment can be so rigidly controlled that the variability of conditions which is so disturbing a factor in experimental work on higher forms is practically excluded.

These are some of the evident advantages that bacteria possess for experimental research in evolutionary biology. It may be proper in this connection to state a few of the results which have been obtained in this field and which bear more

or less directly upon some of the more general questions of biological importance. As has been before intimated, so little direct attention has been given to this subject, that we are scarcely able to predict what results may be expected from the study of these problems from a bacteriological standpoint.

But few laws in nature have a wider expression than that of variation. In fact, it may be said to be co-extensive with life itself. Among the higher complex forms, no two individuals are exact counterparts of each other, but as one passes from the higher to the lower forms of life, the individual differences gradually become obliterated in the more generalized types, and a greater uniformity seems to prevail among the different members of the same species. In such simple protoplasmic elements as the bacteria, all individual variation is concealed, yet, it is presumably present, and were our facilities for recording such infinitesimal variations, sufficient, we would be able to detect structural and functional differences in each cell.

It is too early for us yet to say, whether the evidence that bacteriology may yield will be in favor of the "innate tendency of species to vary," or whether we are to regard variation as an "expression of the influence of environment." An almost untrodden field is before us which lends itself readily to experimental conditions and it is highly important that we interrogate Nature through the medium of investigation upon her more minute, as well as her larger forms of life.

Structural modification expressed either in change of external form or internal characters is usually made the basis for specific differences, so that classifications have been built more upon morphological, than upon physiological characters. A modification then of characters possessing a morphological value would be indicative of a profound change in the constitution of an organism. How far this would be appreciable in the case of bacteria is not definitely settled. A certain amount of form variation, (much more in some species than in others) is to be seen when different media are used for cultivation. Whether these manifestations are merely modifications due to

nutrition or not, it is difficult, if not impossible to say. The question may fairly arise, whether they are due to variations in the food medium or are they entitled to the dignity of varieties and species in the taxonomic sense.

Reproduction is considered one of the most complex and deep seated phenomena of organic life. If we are able experimentally to change the inner constitution of an organic structure to such an extent as to permanently modify its reproductive function, we may justly conclude that a profound change in the original type has been induced. This has been done in the case of the anthrax fever germ. The bacillus that causes this malady is characterized by the ease with which endospores are produced. With a favorable temperature and free oxygen, spores are formed in the vegetating filaments in the course of from 24 to 36 hours. Roux succeeded in producing an asporogenous race of this bacillus by growing them in a nutrient culture medium to which potassium bichromate had been added in the proportion of 1 to 2000. He also succeeded in modifying this reproductive function by the use of phenol. Cultures containing 6 parts of phenol in 10,000 produced endospores in a normal manner, while those seeded in 20 parts to 10,000 were destroyed. Between these limits, the cultures maintained their vitality and grew, but in no case formed spores. When these asporogenous cultures were re-seeded into normal media, they vegetated in a normal manner but did not form spores, although the conditions were most favorable for the process. Behring succeeded in obtaining the same results by the use of rosolic acid. What these observers accomplished by the strict control of cultural conditions, Lehmann observed under more natural conditions. He found that certain cultures that had been cultivated in Koch's laboratory for many generations on gelatine exclusively had lost their ability to produce spores, but their virulence had not been impaired in the least degree. They could not be distinguished from the normal spore-bearing forms in any other than this particular. He tried to modify these varieties, and when the asporogenous type had been grown on a medium suitable for spore production, like potato, for a series of gener-

ations, he finally succeeded in producing forms that contained minute spherical refringent bodies, which in some cases externally resembled true endospores, but *biologically* differed from them materially as they were destroyed by heating for two hours at 60° C while the normal endospores are among the most resistent bodies known. This is a well authenticated instance, where the morphological character of reproduction has been modified, while the salient physiological features of the germ remained constant. This change had evidently been brought about through the influence of exterior conditions, and so deeply had the inner constitution of the germ been affected that it transmitted the character to its progeny although the normal conditions of development did not favor its production.

Were we to admit the evidence of physiological variation, we would find abundant proof among the bacteria that this group of organisms were more or less profoundly modified in their functional characters. Physiological variations have so far received but slight attention at the hands of biologists, but in bacteriology the truth of De Varigny's words that species must be defined not only by means of their anatomical characters, but also in terms of physiological differences, has been amply confirmed. Bacteriology has been forced to add physiological to the morphological diagnosis in the study of these minute forms.

That there is a variation in the characters of certain forms in a perfectly natural state is readily seen in the case of some contagious diseases like cholera. It is known that the peculiar individualities of the cultivations isolated from the different epidemics are so marked, that an expert can tell at a glance whether the culture in question descended from the germ found in the Naples outbreak, or in Egypt, or from India. As one epidemic is often the result of the transference of germs from another, and the two germs therefore more or less related, it is reasonable to infer that environment has much to do with their modification. But we are not confined to the evidence of physiological variation as afforded by examples under natural conditions. These conditions are too fluctuat-

ing and variable. It is only under rigid experimental control that we can obtain positive proof on this question.

The most noteworthy changes are those that show a decided modification of the physiological function of virulence. Nearly every species belonging to the pathogenic class is subject to greater or less variation in this respect. Anthrax fever, the classic example in bacteriology, has been shown by the experiments of Chauveau to vary in virulence to such an extent that from the original virulent culture, varieties or races have been grown that possess every shade of virulence from the deadliest type to that which is perfectly innocuous. These attenuated types maintain their newly acquired function in a perfectly constant manner, so that we have races of the germs that are christened " mouse anthrax," because they are pathogenic for mice only; others less attenuated are able to kill guinea pigs or rabbits, while still others are virulent for all classes of susceptible animals.

With many germs the variation of this functional property occurs quite readily in cultures under ordinary conditions, as in the case of pneumonia and hog cholera, where all degrees of virulence may be found. Sometimes abnormal conditions of environment seem to be necessary to produce the variation. These modified forms may persist only so long as the artificial conditions are maintained, reverting to the original type when restored to their normal environment, or in some species the constitutional characters of the germ are so changed that they are perpetuated although the conditions favorable to atavism are present. What is true concerning the variation of the pathogenic function is likewise true in regard to other physiological characteristics.

The chromogenic property of certain forms has usually been considered of diagnostic value, but in some instances spontaneous sports occur, as in *Bac. pyocyaneus* α and β, where the only observable difference is that the pigment produced in one is a bluish green, while in the other it is a fluorescent green, and quite distinct from the first. This species has been modified artificially so that the color producing power of the organism has been permanently abolished. From other chromo-

genic species like *Bac. prodigiosus*, the germ that causes "bleeding bread" and *Bac. cyanogenus*, that which provokes the disturbance known as "blue milk," varieties have been produced by constant selection and cultivation of cultures in which the color producing quality of the germs entirely disappeared. Laurent modified the chromogenic function of the Kiel water bacillus by exposing it to direct sunlight for a limited time. The suppression of this peculiarity was transmitted from generation to generation so that a perfect albinotic variety was formed. The color property was also lost when cultivated at blood heat and was not regained when continued cultivation was carried on at lower temperatures. These examples indicate the plasticity of this physiological function of color production and show the influence that is exerted upon the germ by a continued subjection to certain experimental conditions.

The objection may be raised that these cases that show a change in the various vital functions do so because their vitality is impaired and that the variety so produced is merely a degenerated and weakened type. While this may be true in certain cases, it does not detract from the value of such experiments as throwing more light upon the question of environmental influence. Besides, the rule is by no means general that loss and abatement of physiological function is correlated with degeneration. We have numerous instances among the pathogenic forms where greater luxuriance in growth is to be noted in connection with the mitigation of the powers of virulence as for instance in tuberculosis where cultivation on media containing glycerin-agar diminishes the virulence of the form while it increases the powers of growth. This can be explained as a case of partial reversion of the species, specialized in the direction of the pathogenic property to an ancestral saprophytic mode of existence.

The zymogenic, or fermentative function of bacteria has also been experimentally modified. The cultivation of the lactic acid bacillus, the germ causing the souring of milk, for a time in non-fermentable solutions, entirely destroys the property of decomposing the sugar in the milk and converting

it into lactic acid. When grown continuously on solid media it likewise loses the power to peptonize or liquefy gelatin, a character of such importance that it is used as a basis for classification.

This variation of function is very marked in the case of some of the marine bacteria.

One Mediterranean species, *Bac. halophilus*, grows only with the greatest difficulty on media that contains less than the normal percentage of salt in sea water, while on media made with sea water it thrives luxuriantly. Constant cultivation however on ordinary media finally so changed its habits that in the course of twenty generations, it flourished as vigorously when supplied with fresh as with salt water.

Another case has recently come under my notice that presents even a more marked change. *Cladothrix intricata*, a common form in the Mediterranean mud was first isolated some 18 months ago. It then manifested no particular preference as to the amount of salt necessary for development, growing equally well on fresh as on salt water media. Since its isolation, it has been kept in stock on agar made with distilled or tap water. This season when an attempt was made to transfer it again to sea water media, it failed to grow. At first, I thought the original stock culture dead, but examining it microscopically I found that all vegetative forms had died, leaving innumerable spores. Seeding an ordinary agar tube from this spore-bearing stock, within 24 hours a copious characteristic growth of the germ was obtained. A second attempt to transfer the germ from the fresh culture, containing only *vegetative* forms was equally unsuccessful. In this instance, not only had the organism lost the ability to germinate when supplied with salt water food but even the vegetating bacilli died when introduced into this medium. This might not be surprising in ordinary terrestrial or fresh water saprophytes, but in a form originally a marine species, it shows a marked modification of nutritive conditions.

Examples like the above indicate that physiological and morphological modifications are so closely related to the environment of the species that it seems almost impossible to

avoid the inference that there is some direct connection between them. Our ability to so rigidly govern the experimental conditions makes the case much stronger for these conclusions, than in those cases where the variations occur spontaneously. Whatever may be the true cause, or causes, that lead to variation among species, it cannot be denied that experiments from all classes of organic life will be valuable in adding to the store of observed facts, and thus giving us a broader basis upon which more accurate generalizations can be made. The evidence already at hand from the realm of the bacteria is promising enough to lead to the conviction that continued experimental work with reference to the problems of variation will be fruitful in results.

Few problems in biology are more prominent in the discussions of to-day than those pertaining to the subject of heredity. Among the different phases of this subject none hold a more important place than the doctrine of the transmission of acquired characters. The difficulties of the question are largely increased by our inability to define exactly what is meant by an acquired character. Under ordinary conditions, it is not easy to sharply differentiate between a variation brought about by an inherent tendency of the organism to vary, and one that is impressed upon the organism from without. We have however in the phenomena of artificial immunity, whereby a susceptible animal is rendered refractory toward a specific disease germ, a favorable field for the study of this problem. Artificial immunity is *par excellence* an acquired characteristic, as it is a deep seated and permanent change in the constitution of the animal that is produced through the influence of an exterior force. Several instances are on record that claim the transmission of acquired immunity in animals from the parent to the young. Chauveau found that the artificial immunity conferred upon goats was transmitted to their progeny but these cases are not pertinent to the problem of the transmission of an acquired character, for the possibility of a direct transference of the immunity by means of the body fluids is not excluded. All cases of the so-called transmission of artificial immunity that are conferred upon pregnant ani-

mals are open to the same objection. That the immunizing substance does permeate the entire body so that even the secretions are affected has been recently proven by the experiments of Ehrlich. He has recently shown that young mice may acquire immunity against that toxic alkaloid, ricin, by being nourished upon the milk of their mother, which has been artificially immunized. He obtained similar results with the tetanus bacillus, by immunizing a mother mouse with serum from a horse when the young were 17 days old. In 24 hours, one of the suckling young was infected with virulent tetanus spores from which it experienced no ill effect, while a control died in 26 hours. Two and three days after the mother had been immunized, other of the young were also tested, and it was found in these cases that the immunity was also transmitted from the mother to her progeny.

If the injection of the immunizing substance into the body of an animal can so permeate the tissues as to reappear in the secretions in 24 hours, it would seem highly probable that the immunity claimed to be transmitted by inheritance might be regarded as passing directly from the mother to her young rather than by means of the germ plasm.

The same objection applies to those cases where infectious diseases are claimed to have been transmitted. Wolff has recently subjected all of these cases to the closest examination, and he finds that only in a very limited number is there any probability that infection is ever transmitted from parent to progeny. In numerous cases of so-called inherited disease, he has actually determined lesions of the placenta, that allowed a direct passage of the germ. He claims that in no case has it been thoroughly proven that disease has been transmitted by the germ-plasm, although it is possible that either male or female generative cell may be diseased, and thus an infection, which he calls *conceptional* may take place.

Ehrlich has recently made some very interesting observations that have a direct bearing upon this question of acquired characters. They possess the advantage of approaching the subject in a fundamental manner, and while they are not numerous enough to justify general conclusions, they are of

great interest as indicating what may be expected from a further study of this subject.

In this case, he experimented with ricin and abrin, those toxic vegetable alkaloids that are so closely related to the poisonous products of bacterial growth. The question at issue in his experiment was, whether the male or the female cell, if either, possessed the ability to transmit artificial immunity to its progeny. His methods were, to first pair a highly immunized male rabbit with a normal susceptible female, and determine whether the progeny possessed any immunity against the toxic substance. In this series of experiments, he found that the descendants invariably succumbed when inoculated with the ordinary fatal dose. From this it is evident, he says, "that the idioplasm of the sperm is not in condition to transmit acquired immunity."[2] He then took up the more complex problem of the inheritance of maternal immunity. The problem in this case is more difficult because we cannot tell with certainty whether the immunizing substance passes to the fœtus by the way of the germ plasm, or directly through the fœtal membranes. This difficulty is partially obviated if the immunity is conferred before fertilization of the egg occurs. But here another disturbing factor arises and that is to confer a permanent immunity for extended periods of time. Repeated tests with these alkaloids demonstrated the permancy of the immunity as very marked in this case, so that they were well suited for experiment on this question. He instituted another series of experiments on rabbits, by pairing an immunized mother with a male of normal susceptibility. Here he found a well pronounced immunity conferred upon the progeny for a certain length of time. At the age of three or four weeks, the young were able to stand ten times the dose that was ordinarily fatal, but in a month and a half it had almost entirely disappeared, and in three months the animal yielded readily to the injection of the normal lethal dose. No

[2]Since this was written, Tizzoni and Centanni have published (Cent. für Bakteriologie, Bd. XIII, No. 3.) the results of a similar series of investigations with rabbits on hydrophobia in which they arrive at a contrary conclusion. Their results are however not uniform but they are of interest in this connectiom as showing how important this field is from an experimental standpoint.

permanent immunity was therefore conferred by the mother.

The temporary immunity can be explained on the assumption of the direct transmission of the anti-toxic substance to the young. He continued the test by pairing animals that were descendants from the progeny of immunized ancestors, but in no case were the descendants refractory toward the toxic substance. These results, although not conclusive upon the disputed question because not continued for a sufficient number of generations, are extremely interesting and go to show that the field of bacterial science offers wide and valuable opportunities for lines of investigation upon problems that have a general biological bearing.

Allusion has been made, and this in only the most cursory manner, to some of the more salient lines of work, and it requires no prophetic vision to see that an experimental field which is so suggestive in its infancy as this has proven to be, must in the future yield a rich harvest to patient systematic investigation.

THE COLOR VARIATIONS OF THE MILK SNAKE.

By E. D. Cope.

The Milk Snake, *Ophibolus doliatus* Linn., ranges in North America over the Eastern, Central and Austroriparian districts, and is absent from the Sonoran and Pacific districts. It is found also in the humid regions of Mexico and Central America, as far as the Isthmus of Darien. Beyond this point it does not occur, but a very similar snake (*Opheomorphus mimus*) is found in New Grenada.

I have called attention to the color variations of this species in a brief paragraph in the introduction to my check list of Batrachia and Reptilia of North America, 1875[1] and have given the characters of the color types, or subspecies, in an analytical key, in a Review of the Characters and Variations of the Snakes of North America, 1892.[2] It is only now possible to give a series of figures representing the North American color forms; a possibility for which I am indebted to the U. S. National Museum. Both Jan and Bocourt have given admirable figures of some of these, but they have thoroughly confused the nomenclature.[3]

The variations of this species are instructive as illustrations of the law of variation, in view of the question raised by the Neodarwinian school as to its promiscuous or definite character. Are variations multifarious or promiscuous as alleged by that school, or do they display a serial passage from a point of departure to a definite goal, as alleged by the Neolamarckians? Researches into the color forms of insects, as those by Eimer in Lepidoptera,[4] and Horn in Coleoptera[5] point to definite series of stages, and my own examination into the color patterns of

[1] Bulletin of U. S. National Museum, No. I, p. 4.

[2] Proceedings of the U. S. National Museum, XIV, p. 589–608.

[3] See memoir quoted at [2] for my synonymy.

[4] D. Artbildung u. Verwandschaft bei Schmetterlinge, Jena, G. Fischer, 1889.

[5] Proceedings of the American Entomological Soc.

the varieties of the lizard *Cnemidophorus tessellatus* and *C. guttatus*,[6] and those of Eimer on *Lacerta muralis*,[7] show distinctly the same phenomenon.

Before going further into the patterns of the *Ophibolus doliatus*, I give a synoptic key of them.

I. No yellow band posteriorly from orbit (a yellow half collar).

a. Dorsal spots or saddles (red) open at the side, their adjacent borders forming pairs of black rings.

Interspaces between red saddles open below; scales not black-tipped; front more or less black; first black ring on nape only *O. d. coccineus.*

Interspaces between red saddles closed by black spot below; scales black tipped; front black; first black ring complete. *O. d. polyzonus.*

Interspaces not closed; rings including first complete on belly; first yellow band crossing occipital plates; front black; scales not black-tipped *O. d. conjunctus.*

aa. Dorsal saddle spots closed at the sides below.

b. Saddles closed by a single black tract on the middle of the belly; no spots between the saddles.

Dorsal spots undivided medially; front black; first black ring complete *O. d. annulatus.*

Dorsal spots divided longitudinally by a median black connection; front black *O. d. gentilis.*

bb. Inferior borders of saddles separate and not confluent with each other.

Saddles completed on gastrosteges; no alternating spots; no black collar *O. d. parallelus.*

Saddles completed on gastrosteges; spots opposite intervals forming a single series on the middle line of the belly *O. d. syspilus.*

Saddles completed above the gastrosteges; alternating spots which do not meet on the middle line of the belly *O. d. doliatus.*

[6] Transac. Amer. Philos. Soc., 1892, p. 27.

[7] Archives f. Naturgischichte, 1881.

II. A yellow band posteriorly from orbit, bounded below by a black or brown one.

a. Saddle spots closed laterally on gastrosteges; alternate spots entirely on gastrosteges.

A half collar behind parietal plates, no superciliary stripe *O. d. temporalis.*

aa. Saddle spots closed above gastrosteges; alternate spots on scales.

A half collar nearly or quite touching occipital plates, no bands; alternate spots largely on gastrosteges *O. d. collaris.*

Neck with longitudinal bands; alternate spots largely on gastrosteges *O. d. clericus.*

Neck with bands; alternate spots entirely on scales *O. d. triangulus.*

In figure 1 are represented vertical, lateral and inferior views of parts of the body of the subspecies *triangulus,* taken from a specimen in my collection from West Chester Co., New York, which I owe to the kindness of my friend Mr. T. H Mead.

The characters of this form are seen in (1) the presence of a light band extending from the posterior angle of the eye downward and backward, which is bounded by a black border above and below; (2) a black cross-band on the posterior border of the prefrontal plates; (3) chevron shaped mark with the apex on the posterior part of the frontal plate, whose limbs extend posteriorly as a band on each side of the neck, where they are fused together, and continue as a single, broad band for a short distance; (4) a series of lateral spots which do not extend beyond the scales on to the gastrosteges, and which alternate with the dorsal spots; (5) a series of spots on the ends of the gastrosteges which alternate with the last mentioned; (6) a series of spots on the centers of the gastrosteges which alternate with the spots mentioned under (5). The ground color in this form is gray, and the spots are a rich brown with black borders. The belly has a white ground color.

In fig. 2 we have the subspecies *clericus,* where the following modifications appear. The fusion of the limbs of the chevron is more complete, and the dorsal spots are more expanded

transversely. They extend to within two or three scales of the gastrosteges, while in the form *triangulus* they are five scales distant. The alternate spots touch the gastrosteges. This figure is taken from a specimen in the Museum of the Philadelphia Academy from southern Illinois.

In fig. 3 we have an individual from Elmira, Illinois, which illustrates the characters of the form *collaris*. Here the chevrons are distinct from the first dorsal spot, whose anterior black border forms a half collar on the neck. This specimen is instructive, as it displays the last connection between the chevron and the first spot, in a black line on each side. This is wanting in the typical form.

The collar of ground color is complete in its anterior border as well as the posterior in the form *temporalis* (fig. 4), owing to the disappearance of the chevron. The transverse band on the prefrontals has also disappeared. The anterior extremity of the postorbital stripe is cut off, and consists of a spot of ground color. The dorsal saddle spots are wider, reaching the gastrosteges, while the intermediate spots are exclusively gastrostegal. The spots which alternate with them, have fused on the middle line. Fig. 4 is from a specimen from the State of Delaware.

In subspecies *doliatus* the postocular stripe has disappeared, and the chevron is replaced by a black patch on the parietal and temporal plates. In other respects this form is more like the form *collaris*. The dorsal saddle spots are separated by a row or two of scales from the gastrosteges, and their alternating spots are partly on the scales. The ground color in this form, as in the *temporalis*, approaches red. This is the form of the tier of states between latitude 40° and the Gulf States.

The subspecies *syspilus* is represented in fig. 7. The head pattern is like that of *doliatus* with the black patch more or less reduced—in the specimen figured being represented by a cross stripe. The dorsal saddle spots are more expanded than in any form yet encountered, their lateral borders being completed below the scales and entirely on the gastrosteges. The alternate spots now meet and fuse on the middle line of the abdomen, and the second series of alternating spots has dis-

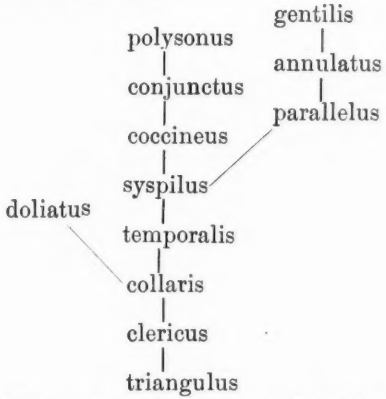
appeared. This is distinctively a southern form, extending west to central Oklahoma.

The dorsal saddles are so far extended in the next subspecies, *parallelus*, as to form two parallel stripes with a narrow strip of ground color between, on the middle line of the abdomen. The alternating spots have disappeared. In the specimen figured, which is from Florida, and is in the U. S. National Museum, the supraocular spots seen in *temporalis*, are indicated. The ground color is red. Black begins to appear on the head.

From the form *syspilus* two types of color modification may be traced. One of these brings the borders of the saddle spots together on the median line, forming a median black stripe; this is the subspecies *annulatus*, which belongs to western Texas and the adjacent parts of Mexico. The top of the head is black (fig. 9). In the other, the lateral borders of the saddle spots have disappeared altogether, so that the body is more or less completely encircled by pairs of black rings, the alternating spots having disappeared. This might be supposed to have resulted from a continuation of the process by which the alternating spots have disappeared, and the edges of the saddles been brought closer and closer together. The continued transverse extension of the spot color would finally obliterate the lateral borders completely, as actually occurs in this last form, the *coccineus* of authors, which is the common type of the Gulf Coast. But the black has not covered the head and muzzle of this form as in the *annulatus*. These regions are on the contrary red, as is the spot color generally, while the ground color is pale yellow.

A tendency to a development of black pigment in the saddle spots is seen in two other forms. The subspecies *gentilis* resembles *annulatus*, but has a black longitudinal dorsal band which divides each saddle spot in two equal halves. This is a rare form, only known from the Indian Territory. The common Mexican form (*polyzonus*) has the paired rings of *coccineus*, the black head of *annulatus*, but each scale of the red intervals is tipped with black.

The relations of these forms may be expressed in a tabular form as follows:



The main series corresponds with a distribution in latitude, commencing with the *triangulus* of New England and New York, and passing gradually to the *coccineus* of the Gulf coast regions, and *polyzonus* of Mexico and Central America. The forms of the right hand column are (except the parallelus), from the central warmer parts of the continent. I think this series of color forms of the *Ophibulus doliatus* demonstrates three points. First; the series is determinate and not indeterminate. Second; the patterns have relation to latitude; the tendency being to make the spot color of the upper regions red, and to extend the area of this color more and more, as we proceed southwards. Third; so far as regards eastern North America, there is a diminution of size in passing from north to south; the *O. d. coccineus* being the smallest of the subspecies. In Mexico, the size is recovered, as the *O. d. polyzonus* equals in dimensions the *O. d. triangulus.*

EDITORIALS.

—During the past few years several institutions of higher education in the United States have begun the publication of the results of work done in their laboratories and seminars. Some regard this new departure with favor, while in the opinion of others it is a matter of regret. Of the aspects as related to Natural History alone we need to speak. The arguments against such publications are weighty. The literature on the subject is enormous; no less than 20,000 pages are required to contain the annual contributions of the world to zoology alone; and every new periodical adds just so much to the difficulty of keeping en rapport with the subject. Again with the multiplicity of periodicals there is a corresponding deterioration on the part of some in the quality of the matter published. With fewer chances for appearing in print the law of natural selection would weed out many a mediocre production.

On the other hand, these new journals have their strong points. America is lacking in facilities for the prompt publication of results. All of our publishing scientific societies are overwhelmed with papers, while our independent journals devoted to research are utterly inadequate to present more than a fraction of the papers of the better class. Combination between institutions to support new journals of the better class is apparently out of the question, while the persons who, like Professor Whitman and Mr. Allis, are willing to pay the deficit of a journal from their own pockets are lamentably few. To conduct investigations with no chance for the publication of the results obtained is discouraging. But since it is only by research that we can ever advance, every aid or encouragement to investigation should be welcomed. We can only hope that the editors of these new journals will exercise due critical care and that they will see to it that every paper published is an actual contribution to knowledge.

The bill recently introduced into the House of Representatives by Congressman Cogswell, appropriating 100,000 dollars for the extermination of the Gypsy Moth in Massachusetts seems to us pernicious. It is, if voted, sure to prove a precedent for further expenditures for the same purpose, for an unlimited term of years. The extermination of this pest is far from an easy task and for several years the State of Massachusetts has been sending good money after bad in its attempt

PLATE XXIV.

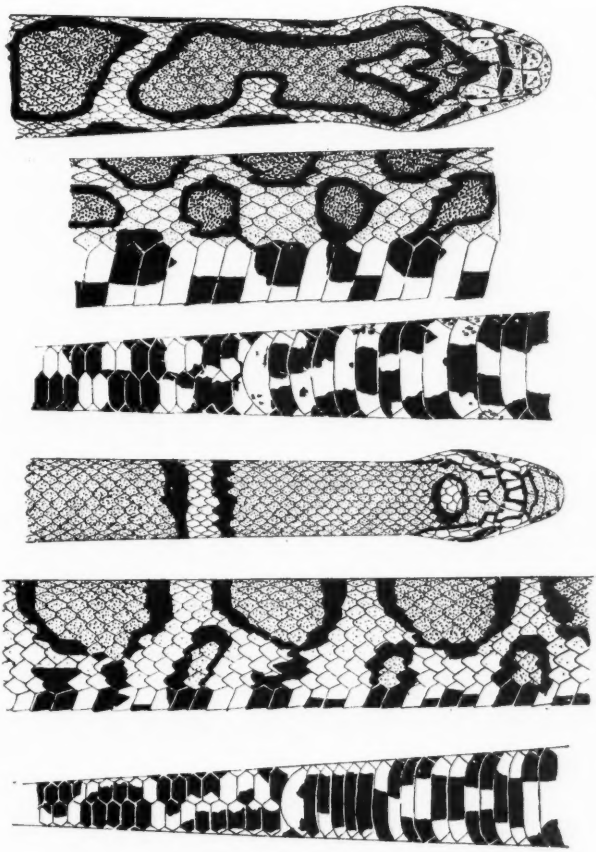


Fig. 1. *Ophibolus doliatus triangulus.*

Fig. 2. *Ophibolus doliatus clericus.*

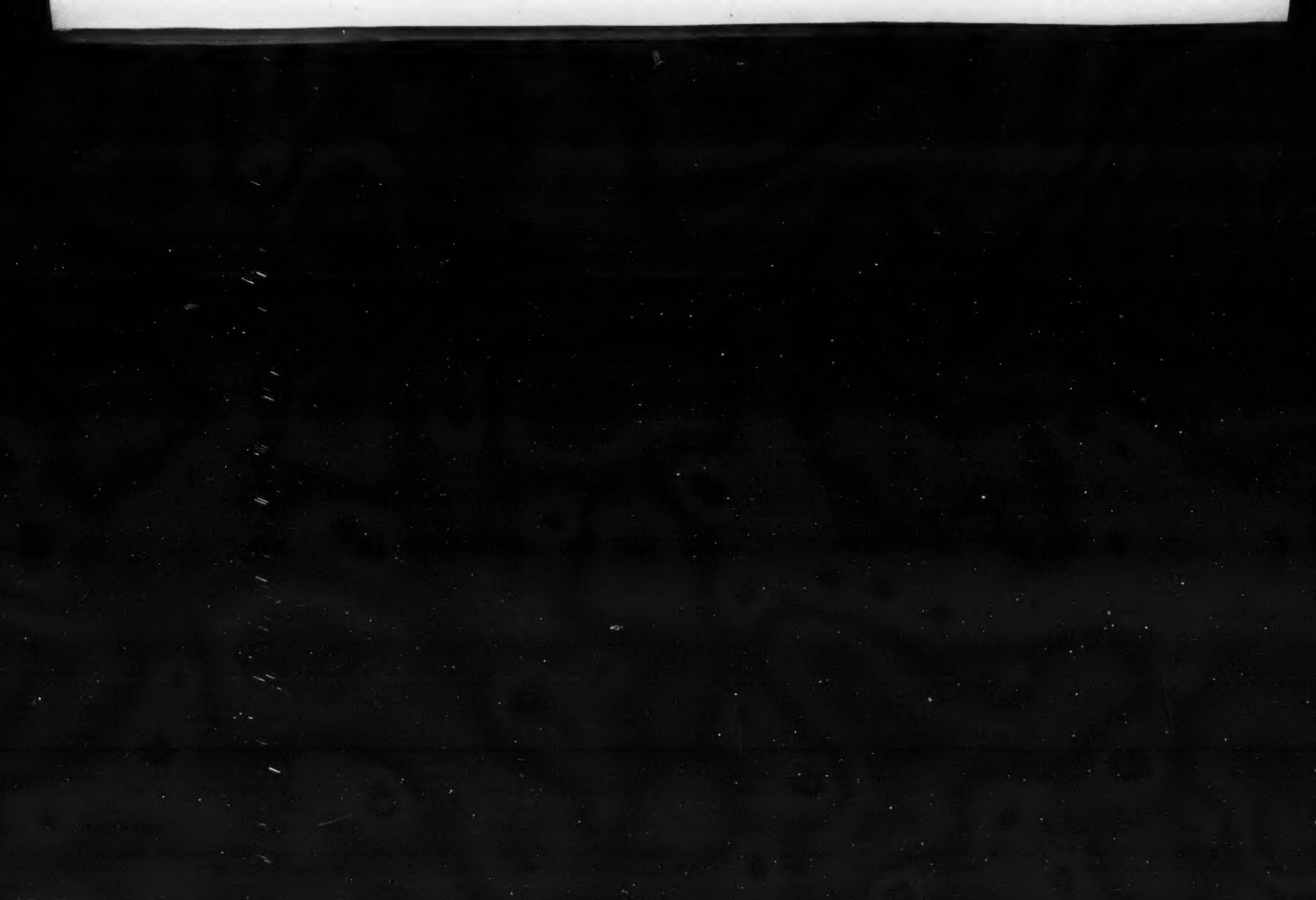


PLATE XXV.

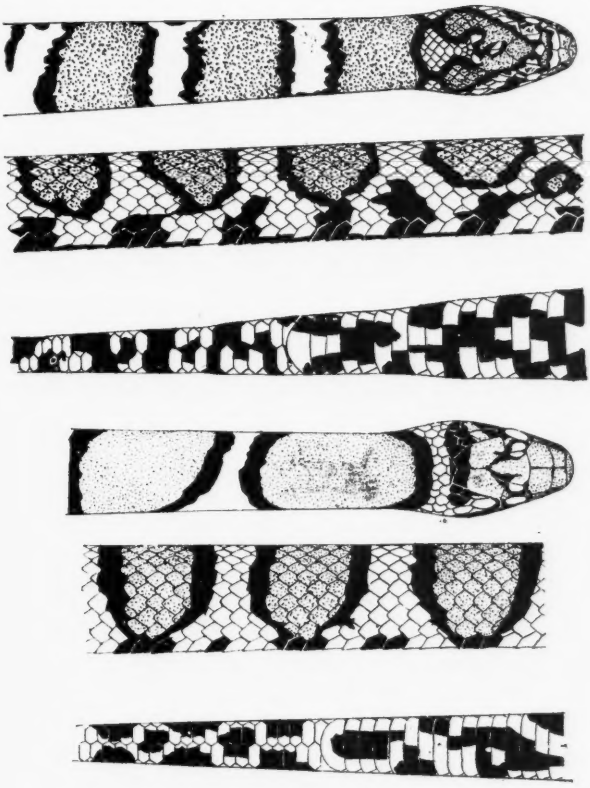
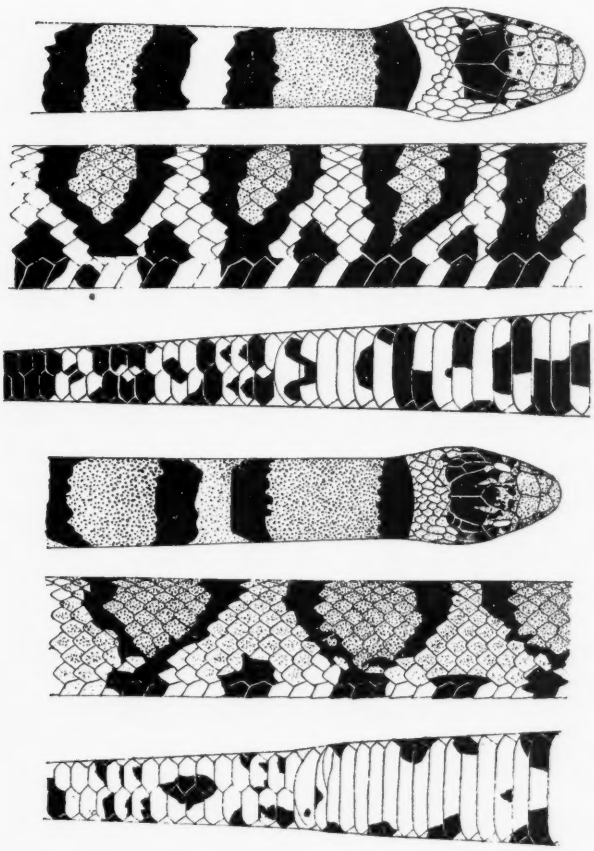


Fig. 3. *Ophibolus doliatus collaris.*

Fig. 4. *Ophibolus doliatus temporalis.*

PLATE XXVI.



Figs. 5–6. *Ophibolus doliatus doliatus.*

PLATE XXVII.

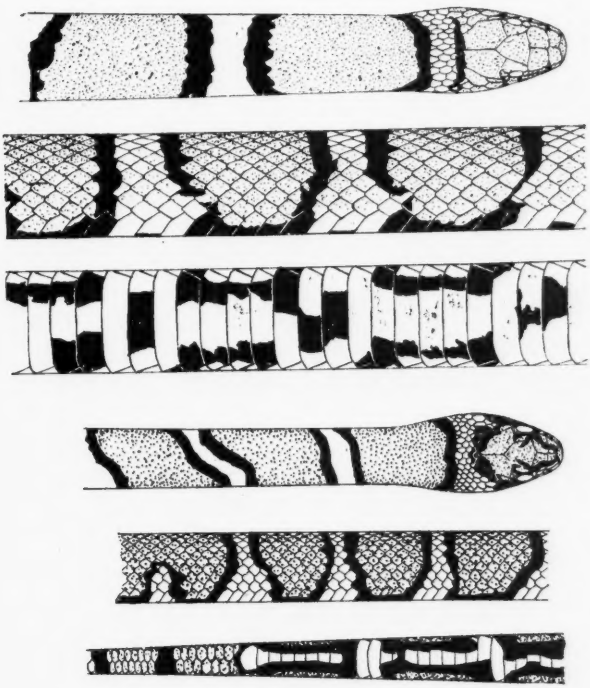


Fig. 7. *Ophibolus doliatus syspilus.*

Fig. 8. *Ophibolus doliatus parallelus.*

PLATE XXVIII.

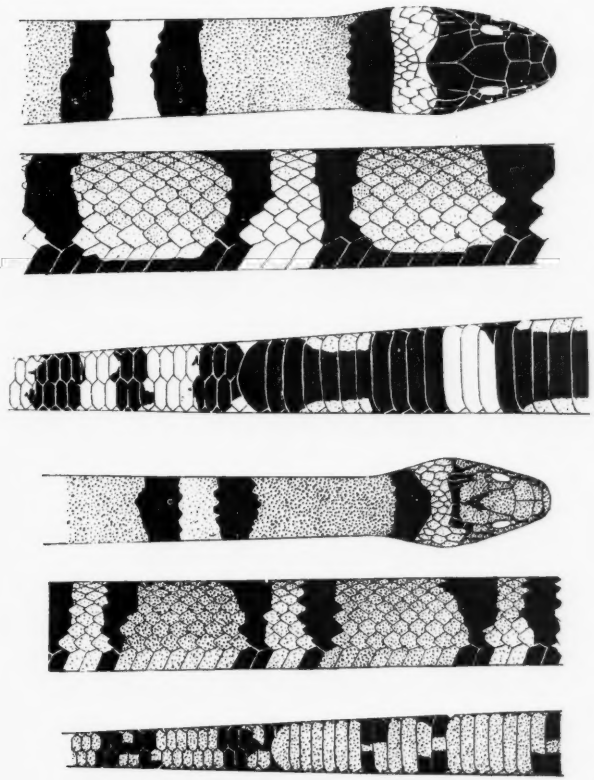


Fig. 9. *Ophibolus doliatus annulatus.*

Fig. 10. *Ophibolus doliatus coccineus.*

to accomplish the impossible task. Suppose for a moment that the various commissions were able to kill every moth except one pregnant female, and were then to rest from their labors. In a few years matters would be as bad as before. The Massachusetts commission have had nothing like such success. Their workmen have undoubtedly killed large numbers of these insects but each year shows the moth in a larger territory than it occupied the year before and extermination is no nearer than it was a dozen years ago. We do not wish to be understood as saying that the Gypsy Moth commission has done no good. It has checked the depredations as it can undoubtedly check them in the future. But this means, if the present methods are continued, a continual drain upon the treasury of the commonwealth which will only cease with that millennium which shall work a change in the morals of insects as well as of man.

In its future work the commission should employ as its head a trained entomologist who should devote his time, not to the hunting of Gypsy Moths in trees, hedge rows and garden patches, but in finding and introducing some natural enemy as has been so successfully done in the case of the Orange Vedalia in California. Moths, eggs, larvæ and cocoons will escape the most careful of field agents, but insect parasites will keep the pest in continual check and render the employment of an army of expensive workmen unnecessary.—K.

The numbers of the American Naturalist for the year 1893 were issued at the following dates, January, Jan. 11th; February, Feb. 4th; March March 8th; April, April 5th; May, May 25; June, June 15th; July, July 24th; August, Aug. 25th; September, Sept. 30th; October, Oct. 31st; November, Nov. 24th, December, Dec, 13th.

RECENT BOOKS AND PAMPHLETS.

ALLEN, J. A.—On a Collection of Birds from Chapada, Matto Grosso, Brazil, made by Mr. H. H. Smith, Part III, Pipridae to Rheidae.

——List of Mammals and Birds collected in Northeastern Sonora and Northwestern Chihuahua, Mexico, on the Lumholtz Archeological Expedition, 1890–92. Extrs. Bull. Am. Mus. Nat. Hist., Vol. V, 1893. From the author.

Annual Report of the Yorkshire Philosophical Society for 1892. From the Society.

BAILEY, V.—The Prairie Ground Squirrels or Spermophiles of the Mississippi Valley. Bull. No. 4, U. S. Dept. Agri. Div. Ornith. and Mam. From the Department.

BALDWIN, S. P.—Recent Changes in the Muir Glacier. Extr. Am. Geol., 1893. From the author.

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RECENT LITERATURE.

Piersol's Histology.[1]—This text-book requires more than a passing notice. The four hundred illustrations, with the exception of a little over ten per cent. of them, are from original drawings by the author, and give to the book an air of originality that is refreshing.

This book is the only American Manual of histology that has yet been published that meets the requirements of modern methods of teaching. It is not overburdened with accounts of methods and descriptions of laboratory appliances, too numerous to be brought into an elementary course. About twenty pages at the close of the volume, are given up to the discussion of the best standard method of fixing, mounting, staining and embedding, that are used in histology, without giving a bewildering lot of detail that is more calculated to appal than to inform the beginner.

This course seems to the writer a rational one, and is a feature that will especially commend the book to students, who wish to get an actual working knowledge of histology.

The descriptive part is full, without being burdened with detail that is of no essential use to the beginner in acquiring an elementary knowledge of the subject. The important tissue-structures and relations of tissues, are indicated in the text with heavy-faced type, so that the student has before him the important points indicated to him by catch-words.

Without pretending to be a treatise on embryology, the subject of the development of the tissues and tissue-elements is dealt with fully enough for the purposes of a text-book especially intended for medical students. The original figures are derived very largely from preparations made from the human subject and the book, therefore, has an added value, from the fact that it is a new contribution to the iconography of the subject.

Sufficient attention is given to the most recent developments in cytology and in the histology of the nervous system, in both of which great recent advances have been made to bring it up to modern requirements. The volume is well gotten up and altogether reflects much credit upon the successor of Professor Leidy, who was, it may not be generally known,

[1] Text-book of Normal Histology, including an account of the development of the tissues and of the organs. By George A. Piersol, M. D., Professor of Anatomy, University of Pennsylvania. 8 vo, pp. 439, with 409 illustrations in the text. Philadelphia, J. B. Lippincott & Co., 1893.

the editor and translator of one of the very earliest text-books published in America on the subject of histology. That the successive occupants of the chair of Anatomy in the University of Pennsylvania should have taken such an important share in fostering the development of histological study in America, should be a matter of pride to all who are interested in scientific and educational progress.—R.

First Annual Report for 1892, Iowa State Geological Survey.[2]—A quarto volume of 474 pages containing the administrative reports, and accompanying papers illustrated by a number of maps and sections, some of them colored, and a number of photo-gravures. Of these papers Mr. Charles Keys contributes three: (1) A summary of the present knowledge of the Geological formations of Iowa; (2) An Annotated Catalogue of Minerals; (3) A Bibliography of Iowa Geology arranged in the form of a dictionary catalogue. The remaining three embody the observations of Mr. S. W. Beyer on the Ancient Lava Flows in the Strata of Iowa, Mr. H. F. Bain's studies of the Distribution and Relations of the St. Louis Limestone in Mahaska County, Iowa, and notes on Niagara Lime-burning Dolomites and Dolomitic Building Stones of Iowa by G. L. Houser.

The Paleozoic Group of Georgia.[3]—Dr. J. W. Spencer's report on the work of the Geological Survey of Georgia is confined to a detailed statement of the geology and economic resources of the Paleozoic Group developed in the northwestern Counties of Georgia. Under the head of Geology, the author gives the general characters of the systems of this group as exemplified in the region under discussion, the recent formations and evolution of northwestern Georgia, the physical features of the country underlaid by Paleozoic rocks, and the local geology of the different countries embraced in the Paleozoic belt. Under Economic Resources the distribution and modes of occurrence, and the character of red and brown iron ores, manganese and aluminum ores, coals, building and paving materials, variability of soils, and water-powers of the country are set forth. In the closing chapter Dr. Spencer gives a bibliography of Georgia geology and a statement of the progress of the survey.

The report is illustrated by 10 plates, 34 cuts, and a geological map.

[2] Iowa Geol. Survey, Vol. I, First Annual Report for 1892, with Accompanying Papers, Des Moines, 1893.

[3] The Paleozoic Group. The Geology of Ten Counties of Northwestern Georgia and Resources. By J. W. Spencer, A. M., Ph. D. F. G. S. (L. and A.) Report of the Geographical Survey of Georgia, Atlanta, 1893.

The Mesozoic Echinodermata of the United States.[4]—This volume, Bulletin No 97 of the U. S. Geological Survey, is the first of a series of reports on American fossil Echinoderms prepared by Dr. William B. Clark. It comprises a systematic review of the Mesozoic Echinodermata of the U. S. in which descriptions of moderate length are accorded the different species; a complete bibliography of the subject; a table showing the geographical range of the American species; and catalogue of the specific names.

Fifty plates illustrate all the species accompany the report, and, according to the author they show many details of structure not recorded in the descriptive portion.

The Flora of the Dakota Group.[5]—This memoir in quarto form was in preparation by Prof. Lesquereux at the time of his death. It was, however, so nearly completed that it has been published with but slight changes from the original wording. The work is limited to the description of fossil plants represented by a large number of specimens obtained at different localities of the Dakota Group, especially in Kansas, and to the evidence derived from the character of the plants in regard to their origin, their relations, and their places in the history of the vegetation of the world.

The original manuscript embraced descriptions and figures of 350 species of plants, but before it could be published, extensive additional collections were made in Kansas. This new material was identified and described by Prof. Lesquereux, and incorporated in the monograph. It added 110 species to the list, making in all 460 species now known from the Dakota Group.

The drawings which accompany the work are life size and occupy 66 plates.

A short account of the life and work of Prof. Lesquereux is given by the Editor in his preface.

Fritsch's Fauna of the Gaskohle of Bohemia.[6]—The important fauna of the Permian formation receives further illustration from the parts of Dr. Fritsch's great work last issued. The first and second

[4] Bulletin of the United States Geol. Surv., No. 97. The Mesozoic Echinodermata of the United States. By William Bullock Clark, Washington, 1893.

[5] Monographs of the U. S. Geol. Surv., Vol. XVII. The Flora of the Dakota Group. A Posthumous Work by Leo Lesquereux. Edited by F. H. Knowlton, Washington, 1892.

[6] Fauna der Gaskohle und Kalksteine der Permformations Böhmen's, von Anton Fritsch; Band II, H. 4, 1889 and Band III, Hefts 1 and 2, 1890, 1893. Prague.

parts now under review are occupied with the Ichthyotomous Elasmobranchii, while the third contains the Acanthodian Elasmobranchs and the Teleostomi of the superorder Actinopterygia.

The descriptions of Ichthyotomi cover several species which the author refers to three genera under the names Orthacanthus Agass. Pleuracanthus Agass. and Xenacanthus Goldfuss. The material at Dr Fritsch's disposal is excellent, and he elucidates thoroughly the structure of the fins of all these forms, and is able to identify the spines and teeth of the different species. We are enabled through the kindness of Dr. Fritsch to give a figure of the *Xenacanthus dechenii* from his work. Thanks to his labors the greater part of the skeleton of these remarkable forms is now well known. There remains some doubt whether the forms distinguished as different genera do not belong to a single genus, as the characters pointed out by Dr. Fritsch to be distinctive in the spines and teeth seem to be specific rather than generic, as has been already argued by Mr. Smith Woodward. If the divided terminal rays of the paired fins of *Xenacanthus dechenii* are not dermal, and only absent from the fins of the other forms by accident, as appears to be the case, then Xenacanthus must be regarded as a genus distinct from the other forms. Dr. Fritsch does not adopt the order Ichthyotomi, but his reasons for this course are not clear.

The subclass Teleostomi is adopted by Fritsch, who states that he does not regard the division of "Ganoidei" as well founded. In this he is in accord with views which I have advocated since 1871, in the face of almost universal opposition. I can only say that paleontologic discovery has long since demonstrated the correctness of this position, and its general acceptance cannot be long delayed. Fritsch remarks that Smith Woodward adopts my order of Ichthyotomi with a new definition, as though it were the division proposed by Cope. But he is evidently not aware that I redefined the order, on the basis of the discovery of the fin structure by Sauvage, in a synopsis of the Families of Vertebrata published in the AMERICAN NATURALIST for Oct., 1889, with which the later definition of Woodward in the Catalogue of Fishes of the British Museum (1891) nearly agrees.

The only form of Actinopterygian fish described, is the genus Trissolepis, which is referred to the Chondrostei. It possessed a raptorial dentition of acute teeth, and scales of both ctenoid, cycloid and ganoid forms, the last on the caudal region only. The following figure from Fritsch's work represents this interesting form.

Of Acanthodii, species of the genera Traquairia, Protacanthodes, and Acanthodes are described; the first two genera being new to science.

Machaeracanthus is also referred tothis order. The author accepts the reference of the Acanthodii to the Elasmobranchii.

Dr. Fritsch makes the important discovery of the scales of Ceratodus, which resemble those of the existing species.

The present work is the most important one of modern times in the amount of light which is thrown on the structure of the primitive fishes.—E. D. Cope.

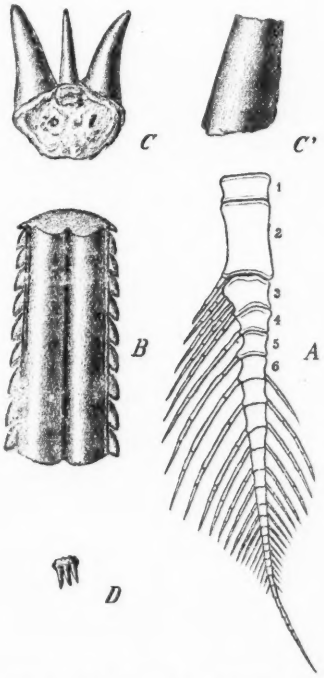


Fig. 1.—*A* Pectoral fin of Xenacanthus (Pleuracanthus). *B* Cephalic spine. *C* Tooth; *C'* Tooth magnified. *D* Gill prickles; all of Xenacanthus (Pleuracanthus).

Explanation of Plates.

Plate XXIX. *Xenacanthus dechenii* Goldf; from Fritsch.
Plate XXX. *Trissolepis kounoviensis* Fritsch; from Fritsch.

General Notes.

GEOLOGY AND PALEONTOLOGY.

Mud Avalanches in the Mustagh Mountains.—During a recent exploration in the Mustagh Mountains in India, Mr. W. M. Conway noticed the accumulation in the valleys, of debris consisting of stones as often rounded as angular, embedded in mud. In the Gilgit valley this accumulation reaches a depth of 1000 feet or more. The author claims that the work of filling up the valleys, not only in the Mustagh Mountains but all the deeply filled valleys characteristic of the Central Asian plateau, has been done by mud avalanches, and he gives the following interesting account of one of which he was an eye witness.

"We were just approaching the mouth of a deep, narrow nala that crossed our path when we heard a noise as of continuous thunder, and beheld a vast black wave advancing down it at a rapid pace. Some accumulation of water had got loose high aloft, and the flood was bringing the hill down with it. When we reached the edge of the nala the main mass of the stuff had gone by and only a thick, black stream of mud was rushing swiftly past. This became by degrees more liquid until it was no longer mud but black water. We waited for some time till the waters subsided. At length Harkbir found a way across the torrent by leaping from stone to stone. We had begun to follow him when Karbir, who was looking up the nala, shouted to us to come back, which we did with the nimblest feet. We were not more than out of the ditch before another huge mud avalanche came sweeping down. It was a horrid sight. The weight of the mud carried huge masses of rock down the gully, rolling them over and over like so many pebbles, and they in turn dammed back the muddy torrent and kept it moving slowly with accumulating volume. Each of the big rocks that formed the vanguard of this avalanche weighed many tons; the largest were about 10 feet cubes. The stuff that followed them filled the nala to a width of about 40 feet and a depth of about 15 feet. The thing moved down at about the rate of five miles an hour. When the front of the avalanche was gone, and the mass of stuff became shallower, the mixture was about half mud, half rocks, and flowed faster. Now and again a bigger rock than the average would bar the way; the mud

would pile up behind it and presently sweep it on. Looking up the nala we could see the sides of it constantly falling in and their ruins carried down. Three times did the nala yield a frightful offspring of this kind, and each time it found a new exit into the main river below, and entirely changed the shape of the fan. The third avalanche was the largest of all, and fortunately left a causeway of stones, reaching almost across the nala, at our very feet. Some big fall must have presently taken place higher up and dammed back the waters, for the stream ran almost dry and we were enabled to cross the gully without difficulty.

"Assuming that one of the avalanches we saw travelled at the rate of only 7 miles an hour=200 yards a minute, and took only 7 minutes to pass any point, it would be 1400 yards long. Call its average width 8 yards, and average depth 2 yards, it would consist of over 10000 cubic yards of stuff. Suppose three-fourths of this to have been water, you get 2500 cubic yards of débris discharged by one of these avalanches, and we saw three come down a single gully, where others had fallen before we arrived and others fell after we left. 15000 cubic yards is a low estimate for the fall of that one day down that single and relatively small gully. One gully of this sort to every mile of valley is a minimum computation. It is easy to see then what a powerful element mud avalanches must be in determining the physical features of this region of the earth." (Geog. Journ., Oct., 1893.)

Cladodont Sharks of the Cleveland Shale.—The fossil sharks recently discovered in the Cleveland shale are of especial interest and importance because they show definitely the form of structure of these early Elasmobranchs. Professor E. W. Claypole has made them the subject of a paper in the American Geologist, May, 1893. The material now at hand represents four species of *Cladodus*, and two of *Monocladodus*. These genera are closely allied, but the absence of lateral denticles, in the opinion of the author, marks a generic difference. *M. clarkii* is distinguished by the fact that the teeth stand in pairs, one close behind the other. *M. pinnatus* is represented by a single specimen which is unique from the great strength of the ventral fins, whence comes its specific name. Both of these species are figured, together with *Cladodus sinuatus*, *C. clarkii*, and *C. rivi-petrosi*. Professor Claypole gives also an amended description of Newberry's *C. replerii*. The genus *Monocladodus* is very near to, if not identical with *Styptobasis* Cope.

The Neocene Sierra Nevada.—The observations recorded by Mr. Waldemar Lindgren in a paper on Two Neocene rivers of California appear to prove conclusively (1) that the Sierra Nevada in Neocene times, in the watersheds of the Yuba and American rivers, formed a mountain range as distinct as that of to-day, and that its first summit in general, coincided with the corresponding modern divide; (2) that the slope of this range has been considerably increased since the time when the Neocene ante-volcanic rivers flowed over its surface; (3) that the surface of the Sierra Nevada has been deformed during this uplift, and that the most noticeable deformation has been caused by a subsidence of the portion adjoining the great valley relatively to the middle part of the range. (Bull. Geol. Soc. Am., June, 1893.)

Geological News. Paleozoic.—In Notes on some Devonian plants from New York and Pennsylvania, Mr. Penhallow describes a new species, which he refers to the genera *Haliserites*, *Dictyotites* (gen. nov.) and *Psilophyton*. From the data afforded by these plants the author gives a fresh definition of the characters which distinguish *Haliserites* and reintroduces the *Dictyotites*, once used by Brongniart, but which had been abandoned by authors. (Proceeds. U. S. Natl. Mas., Vol. XVI, 1893.)

Mr. C. S. Prosser calls the attention of geologists to lists of fossils from eastern New York and Pennsylvania, with statements of their stratigraphic position, which show that the fossiliferous zone underlying the Oneonta sandstone in Chenango and Otsego counties, New York, is not the top of the Hamilton but belongs to the Portage stage. (Proceeds. U. S. Natl. Mus., Vol. XVI, 1893.)

A new fossil sponge has been found in the shales of the Quebec group at Little Metis, Canada. It was probably of sac-like form and about 14 inches in diameter. Its walls consist of rhombic meshes made up of delicate spicules loosely twisted together and apparently branching at the angles. This sponge is the largest and most complex yet found in formations of so great age. Dr. Hinde proposes to place it in the new genus, *Palæssaccus*. (Bull. Geol. Soc. Am., Sept., 1893.)

Mesozoic.—In a contribution to the invertebrate paleontology of the Texas Cretaceous Mr. F. W. Cragin describes 151 species, of which 1 Cœlenterate, 17 Echinoderms, and 86 Molluscs are either new species or varieties. This collection belongs to the Museum of the Texas Geol. Surv. and comprises the Cretaceous fossils accumulated during the field work of four years. (Fourth Ann. Rept., Texas Geol. Surv. for 1892.)

The recent figures and descriptions of European Pterodactyls published by Professor Seeley have satisfied Mr. S. W. Williston that the generic characters of Pteranodon Marsh are included in those of Ornithostoma Seeley, and he accordingly states that the Kansas species hitherto placed in the genus Pteranodon may now be known under the earlier generic name of Ornithostoma, and the family as the Ornithostomatidæ. (Kansas Univ. Quart., Oct., 1893). In this same publication Mr. Williston gives a life size restoration of *Clidastes velox* Marsh based upon an unusually complete specimen of this Mosasaur from western Kansas.

Two new species of invertebrates *Ostrea munsonii* and *Radiolites davidsonii*, from the Caprina limestone of Texas are figured and described by Mr. R. T. Hill. In a preface to the descriptions the author states that this formation is of great interest from the fact that in it we have all the species of the aberrant Chamidæ and Rudistes known to occur in the United States, with the exception of Coralliochama of California and the *Radiolites austinensis*, forms common in the Upper Cretaceous of Alabama, Texas and Colorado. (Proceeds. Biol. Soc. Wash., 1893.)

Mr. W. M. Fontaine's examination of the collection of fossil plants from the Trinity division of the Comanche series of Texas results as follows: Equisetum, 1 sp. nov.; Ferns 1; Cycads 7, of which 1 is new; Conifers 10, 4 new, uncertain 4, of which 3 are probably new. The author considers the plant bearing portion of the Trinity to be somewhat older than the basal Potomac strata, but the difference in age is not great. (Proceeds. U. S. Natl. Mus., 1893.)

A small collection of fossil plants from the Kootanie group of Great Falls, Montana, has been examined by Mr. Fontaine. The specimens show nothing but ferns, conifers and one Equisetum. The conifers are badly preserved. Of the 9 ferns 5 are new, descriptions of which are given in the Proceeds. U. S. Natl. Mus., Vol. XV with plates. Cycads are rare in the Great Falls flora, none being found in the collection examined. The one figured in the paper mentioned under the name *Zamites montanensis*, was obtained from this field by Mr. Williams, and is described by Mr. Fontaine from a drawing. This collection confirms Dr. Newberry's conclusions that the Potomac group, the Great Falls group, the Kootanie group of Canada, and the Kome group of Greenland are all of the same general age.

Cenozoic.—In studying the Finger Lakes of Western New York, Mr. A. P. Brigham concludes that the basins are a composite

resultant of valley erosion, glacial scoop, and drift barriers, with perhaps a slight element of orography. The deepening of the lakes to the southward is the result of the narrowing of the ice between contracting valley walls which increases the vertical pressure and hence intensifies the erosion. (Bull. Am. Geog. Soc., 1893.)

In a review of the knowledge of the paleolithic man in North America M. Boule remarks that the recent work of Mr. Holmes does not invalidate the discoveries of paleolithic objects in America, and particularly those of Dr. Abbott, which M. Boule considers to be "true finds" in every sense of the word.

It is suggested by Mr. F. W. Hutton that the Ostriches of Africa and South America have orginated in the Northern Hemisphere possibly as swimming birds—and the Gastornithidæ, which have relations with the Anatidæ, may be their ancestors. (Proceeds. Austral. Assoc. Adv. Sci., 1892.)

According to Dr. Du Riche Preller, the Engadine Lakes owe their origin to the subsidence or dislocation of the old divide of the Inn and Bargalia systems, and the consequent deflections to the south of the original Inn sources. From a powerful Alpine torrent the Inn was reduced to a small stream without sufficient volume or fall to carry away the deposits brought down by lateral torrents. These deposits accumulated and thus the lakes were formed by the weakened river being banked up at various points. (Geol. Mag., Oct., 1893.)

From the evidence of marine fossil shells in the Bowlder Clay on the Bay of Fundy just west of Saint John harbor, Dr. Robert Chalmers concludes that the height of the land on this part of the Bay during the Glacial period must have been 100 to 200 feet lower than at the present day, relatively to the sea. Also since the striæ on the rocks underneath the bowlder-clay indicate several ice movements varying in direction from S. 2° W. to S. 65° E. the formation of the lower bowlder-clay cannot all be due to one body of ice. (Bull. Geol. Soc. Am., 1893.)

MINERALOGY AND PETROGRAPHY.[1]

The Schists of Southern Berkshire, Massachusetts.—The sericite schists of southern Berkshire Co., Massachusetts, and northern Litchfield Co., Conn., contain phenocrysts of feldspar, garnet, staurolite, tourmaline, biotite, and ottrelite, imbedded in an aggregate of feldspar, quartz and sericite, which contains, besides the phenocrysts, a large number of metamorphic minerals. The large feldspars are often filled with secondary granophyre, and this mineral, the garnet and the tourmaline, are frequently built out by secondary enlargements. The core of the feldspar is so often bounded by crystal outlines that Hobbs[2] regards the mineral as having resulted from the recrystallization of the clastic grains of the original rock. The garnets, in addition to their peripheral enlargements, are often possessed of a rim of staurolite and magnetite crystals, supposed to be the product of reactionary action between the garnet and the surrounding minerals. The author believes the phenocrysts to have been developed by static metamorphism (simple pressing) from the constituents of a fragmental rock.

The Phonolytes of the Hegau.—The phonolytic rocks of the Hegau, Eifel, Germany, so well-known because of the beauty of their hauyne constituents, have been subjected to a comparative study by Cushing and Weinschenk,[3] who find them not all phonolites, as they have heretofore been regarded. The essential characteristic constituents of the group are sanidine, nosean, hauyne, nepheline, leucite, augite and aegerine, and the accessories, biotite, apatite and zircon. All the rocks are more or less porphyritic, with sanidine and the members of the hauyne group in two generations. Of the latter the larger crystals and those of the first generation are hauyne; the smaller, those of the second generation, nosean. The former are always more or less altered into zeolites, while the latter are usually fresh. Contrary to the general statement made with regard to these two minerals, the hauyne is not always blue nor the nosean colorless, but rather is the opposite the case. An important discovery made during the investigation is to the effect that nepheline is by no means common

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.
[2] Bull. Geol. Soc. Amer., Vol. IV, p. 167.
[3] Minn. u. Petrog. Mitth., XIII, p. 18.

in the Hegau rocks. In a few of them the mineral is abundant in the usual form. In others it is only sparingly present, while in still others it is absent so far as could be learned. Consequently, the rocks fall into several classes. The Hohentwiel occurrences are of nosean-phonolites, in which nosean is abundant in the groundmass and nepheline absent. The specimens from Mägdeberg and Schwindel are noseanophyres (corresponding to the leucitophyres), in which nosean and nepheline are both present. At Staufen, two types were found, one a leucite-phonolite, and the other a true phonolite (nepheline-phonolite). The rock of Gonnersbohl is a hauyne-bearing trachyte or a trachytic phonolite. Each of these types is briefly described, and at the conclusion of the paper a few pages are devoted to an account of the tufa associated with them.

The Rock of a New Island, off Pantelleria.—An island, measuring one kilo. in length, and two hundred metres in width, was projected above the water off Pantelleria during the earthquake week beginning Oct. 14, 1891. The new island is an aggregate of loose blocks and solid lava, whose characteristics have been described by Foerstner.[4] The material in his possession was mainly a black pumiceous basalt of the composition:

[4] Minn. u. Petrog. Mitth., XII, 1892, p. 510.

SiO_2	TiO_2	Al_2O_3	Fe_2O_3	Feo	MnO	CaO	MgO	K_2O	Na_2O	H_2O	Total
44.64	5.86	12.74	4.21	11.17	.20	10.12	5.82	1.41	4.31	.51	=100.99

Attention is called to the large quantity of TiO_2 revealed by the analysis. Under the microscope the groundmass of the rock is seen to be a dark glass filled with highly colored microlites, and enclosing phenocysts of anorthite, olive-green augite, olivine and magnetite. The glass is sometimes in large quantity and at other times is present only in traces. The rock is a tachylitic basalt like that of Pantelleria and the other neighboring islands.

Petrographical News.—The pyroxenite of Duerne, Dept. of the Rhone, France, is an aggregate of orthoclase, pyroxene, oligoclase, garnet, and quartz. The structure of the rock varies from pegmatitic to granular. Its pyroxenic component is described by Gonnard[5] as light green in color, and as often possessing crystal outlines. It includes within its mass many crystals of sphene. Druses of vesuvianite line the walls of crevices in the rock, and galena is not an uncommon constituent of tiny veins traversing it.

[5] Bull. Soc. Franc d. Min., XV, p. 232.

PLATE XXIX.

Xenacanthus decheni Goldf.

In the northern Hardt Mountains, near Obbersweiler, Waldhambach and the neighboring regions, are biotite and hornblende gneisses that are probably squeezed granites, schists and graywackes, altered by an intrusive biotite granite and cut by other granites, a kersantite dyke cutting the intruded granite, and a sheet of quartz melaphyre overlying all these as a lava flow, the whole comprising the mass of the mountains. All these rocks Leppla[6] discusses in a recent article, describing the melaphyre as consisting of a groundmass of plagioclase and quartz enclosing phenocrysts of feldspar, red olivine pseudomorphs, quartz and bastite. The quartzes are all surrounded by aureoles of augite, just as are the quartz inclusions in many basic rocks.

In a monograph in the Kaiserstuhl in Baden, Knop[7] gives a general view of the geology, mineralogy and chemistry of this interesting volcanic region, in addition to statements concerning its hydrography, botany, history, etc. All the minerals known to the region are described at considerable length, and over a hundred and fifty pages of the book are devoted to descriptions of its interesting rocks, phonolites, andesites, tephrites, basanites, basalts, limburgites among the volcanics, and several others of sedimentary origin. The author treats the hill as an old volcano, and attempts to explain the variety in its products upon the Bunsen theory of mixed magmas.

A two-mica gneiss[8] constitutes the principal rock of the Valley of Miñor, Provice Pontevedra, Spain. On the peninsula of Santa Marta it is cut by a diabase with faintly pleochroic augite. At Monte Galeñeiro the micaceous gneiss is replaced by a hornblendic variety in which the prominent amphiboles are glaucophane and a green variety opaque to light vibrating parallel to *c*.

Chelius[9] describes very briefly several occurrences of nepheline basalt from the Odenwald, Germany, and records the analyses of the red gneiss of Steinkopf, of the dark biotite gneiss of Bockenrod, of basalt from the Häsengebirg near Urberach, of granite from the Melibocus massiv, and the results of silica and specific gravity determinations of many other rocks from the same region, among which may be mentioned malchite and alsbachite.

[6] Zeits. d. deutsch. geol. Ges., XLIV, p. 400.

[7] Der Kaiserstuhl in Breisgau. Ein naturwissenschaftliche Studie von Dr. A. Knop. Leipzig. W. Engelmann, 1892, p. 538 and fig. 89.

[8] Quiroga: Actas d. l. Soc. Esp. d. Hist. Nat., XXI, 1892, pp. 4 and 8.

[9] Notizbl. d. Ver. f. Erdk. Darmstadt., IV, 1891, H. 12.

Though the parallel growths of augite and hornblende, with the latter mineral surrounding the former, are common, the reversed phenomenon is rare. Hobbs,[10] however, has recently pictured an example of light green amphibole completely encircled by colorless augite from an augite-hornblende rock occurring at New Marlboro, Mass.

Analyses of American Minerals.—Several analyses of dodecahedral crystals of *aguilarite* from Guanajuato, Mexico, have been made by Genth and Penfield.[11] That from the purest material gave: Ag = 84.40 %; Cu = .49 %; S = 11.36 %; Se (diff) = 3.75 %. The mineral is thus an argentite with an eighth of its S replaced by Se. *Metacinnabarite* particles disseminated through barite from San Joaquin, Orange Co., Cal., gave the same authors: Hg = 85.89 %; S = 13.69 %; Cl = .32 %. The mineral supposed to be *leucopyrite*,[12] from Alexander Co., N. C., is *lollingite*, whose composition is Fe = 70.83; Cu = tr; As = 27.93 %; S = 77 %. *Rutile* crystals with the habit of cassiterite are found in the quartz decomposition products of the orthoclase from West Cheyenne Cañon, El Paso Co., Col. They are iron black with a density of 4.249, and the composition: $SnO_2 = 1.40$; $TiO_2 = 91.96$; $Fe_2O_3 = 6.68$. The *quartz* decomposition products referred to yield, upon analysis:

SiO_2	Al_2O_3	Fe_2O_3	Na_2O	K_2O	Loss	Total
96.63	.93	.85	tr.	.46	.95	= 99.82

Pieces of a large *danalite* crystal from the same locality, give:

SiO_2	BeO	CuO	ZnO	FeO	MnO	S.	Loss	Total—O
30.26	12.70	.30	46.20	6.81	1.22	5.49	.21	100.41

The danalite is associated with quartz, astrophyllite and a new yttrium calcium fluoride with a hardness of 4 and a density of 4.316. Its composition is: CaO = 19.41; $(Yt\ Er)_2O_3 = 47.58$, etc. The other minerals whose analyses are recorded by the authors, are: altered zircon (*cyrtolite*) from Mt. Antero, Col.; *lepidolite*, from Tanagama Yama, Japan, and *fuchsite*, from Habershaw Co., Ga. The analyses of the lepidolite and fuchsite follow:

[10] Sci., Dec. 23, 1892, p. 354.
[11] Amer. Jour. Sci., Nov., 1892, p. 381.
[12] Bull. U. S. Geol. Survey, No. 74, p. 26.

	SiO_2	Al_2O_3	F_2O_3	MnO	MgO	CaO	Li_2O	Na_2O	K_2O	H_2O	Fl	Cr_2O_3	CuO
L.	53.34	17.76	3.25	2.77	.05	.37	4.60	1.55	10.90	.65	7.78		
F.	46.73	29.00	2.59		3.03			.26	9.25	6.04		2.73	.14

Among some analyses[13] made in the laboratory of the University of Virginia are the following, which are of interest to mineralogists: *Cuproplumbite* from Butte City, Montana, analysed by De Bell, gave: Cu = 61.32; Pb = 18.97; S = 17.77; quartz = 1.58; corresponding to 5 Cu_2 S. Pb S. *Calamine*, from New River, Wythe Co., Va., yielded Jones: SiO_2 = 25.33; ZnO = 67.15; H_2O = 7.47; Total = 99.95. *Parantite*, from a pocket in a corundum vein of the Hiawassee Corundum mine, Hayesville, Clay Co., N. C., is associated with decomposed albite and various chlorites. It is in rounded blue-gray lumps, having a density of 2.75. Analysed by Berkeley, it gave:

SiO_2	Al_2O_3	CaO	Na_2O	H_2O	Total
47.54	34.03	17.23	1.82	1.02	= 101.64

North American Minerals.—Remarkably large crystals of *seleeuite* have been found by Talmage[14] in the drainage area of one of the side cañons of the Tremont River, Wayne Co., Utah. Gypsum in seams cuts through the sandstone and argillite of the region in great profusion. The largest crystals of the minerals were in a geode-like cave, left exposed as a hollow mound in the slope of a hill. The interior of the cave was studded with great columns and slabs, extending from its sides sometimes to a distance of 51 inches. Many of the crystals are transparent throughout their entire length.

Fairbanks[15] describes the *rubellite* and *lepidolite* of southern California as occurring in a pegmatite vein cutting norite near Pala, west of Smith's Mt, San Diego Co. Besides the feldspar and the quartz there are associated with the two minerals above mentioned: muscovite, hematite, and green and black tourmalines.

A few very fine *datholite* crytals from the Lacy Mine, Loughboro, Ontario, have been measured by Pirsson.[16] The manner of their occurrence is not certainly known, but they appear to be in a vein penetrating an eruptive rock. The crystals are described as the finest yet

[13] Amer. Chem. Jour., Vol. XIV, 1892, p. 620.
[14] Science, XXI, 1893, p. 85.
[15] Ib. XXI, p. 35.
[16] Amer. Jour. Sci., Feb., 1893, p. 100.

found in America. They are transparent, yellowish, and in size the largest measure 3 x 2.5 x 2 cm. Their habit is prismatic parallel to *a*, and each individual is bounded by many faces.

In and upon calcite crystals lining some of the geodes of Keokuk, Iowa, Keyes[17] announces the discovery of very handsome tufts and radiating masses of *millerite.*

Beds of specular *hematite,* intermixed with *martite,* are reported by Hill[18] as abundant at the junction of diorite and limestone in many localities within the State of Coahuila, México.

Physical Properties of Minerals.—A series of new determinations of the specific heat of *boracite* at different temperatures is reported by Kroeker.[19] The materials experimented upon were four transparent crystals from Linneberg, one piece being from a large crystal with a cubical habit, and the others fragments of dodecahedral crystals. In all cases it was found that the specific heat of the mineral varies with the temperature, and that the increment of variation increases rapidly between 250°–270°. Below 270° the cubic and the dodecahedral crystal gave similar results, above this temperature the results are different. For details of the experiments the reader must be referred to the author's paper.

Two articles of interest to mathematically inclined physical mineralogists are the one by Pockels[20] on the changes effected in the optical characterists of *alum* and *beryl* by pressure acting in a single direction, and the other, by the same author,[21] on the elastic deformation of piezo-electrical crystals in the electrical field.

Traube[22] finds that the following compounds, all of which form dextro-rotatory solutions, are hemi-morphic, viz.: $Sr(SbO)_2(C_4H_4O_6)_2$, $Pb(SbO)_2(C_4H_4O_6)_2$, and $Ba(SbO)_2(C_4H_4O_6)_2+H_2O$. All are also tetartohedral—the strontium and lead compounds being the first examples of hemimorphic tetartohedral substances crystallizing in the hexagonal system, and the barium salt the first instance among tetragonal bodies.

[17] Amer. Geologist, XI, p. 126.
[18] Amer. Jour. Sci. XLV, p. 111.
[19] Neues Jahrb. f. Min., etc., 1892, p. 125.
[20] Neues Jahrb. f. Min., etc., B. B. VIII, p. 217.
[21] Ib. B. B., VIII, p. 407.
[22] Ib. B. B., VIII, p. 269.

One of the micas[23] in the Mte. Dorè trachyte is an *anomite* with an optical angle of 41°. When treated with boiling hydrochloric acid it loses its greenish color, with the extraction of its iron and magnesium, and becomes less strongly doubly refracting. After an hour's treatment it becomes colorless and uniaxial, when its optical sign is negative.

Having examined seventy-one uniaxial minerals with respect to their heat conductivity, Jannetaz[24] finds that only five contradict his law that the major axis of the isothermal ellipsoid is parallel to the direction of the principal cleavage, and the minor axis normal thereto.

Instruments.—Laspeyres[25] describes a modification of the setting of the condenser above the polarizer of the microscope, that enables the observer to change rapidly from converged to parallel light, even when an object is being examined. The lower nicol is in its usual position. The condenser is imbedded in a metal strip set into the stage, and sliding easily in a groove prepared for it.

A goniometer with two circles, enabling the operator to measure nearly all the planes on a crystal with one adjustment of the latter, is explained in detail by Goldschmidt,[26] who also illustrates its use by several examples.

[23] Bull. Soc. Franc d. Min., XV, 1892, p. 97.
[24] Ib. XV, p. 133.
[25] Zeits. J. Kryst., XXI, p. 256.
[26] Ib., p. 210.

ZOOLOGY.

The Molluscs of the Water Mains of Paris.—M. Locard has made a study of the malacological fauna of the water mains of Paris as represented in the material now in the possession of the Geneva Museum. The author finds that the collection embraces 44 species referable to 13 genera. Among them are four new species, *Dreissensia paradoxa, D. curta, D. tumida* and *Amnicola lutetiana.* Neither Unios or Anodontas are found. The author attributes their absence to the absence of fish to which the larvæ of these species are in the habit of attaching themselves.

M. Locard notices four modifications of the molluscs in the water mains of Paris from the original types whose habitat is in the waters supplying these mains. (1) Diminution of size, due to absence of light. (2) Decrease of coloration owing to the same cause. (3) Modifications of form, generally a lengthening of the shell, due to the mechanical action of a steady, rapid current. (4) Appearance of the shells. They are polished, brilliant, uniform, developing with regularity in a constant medium. (Revue Scientifique, Oct., 1893).

The Orthopterous Insects of the Galapagos Islands.—The various collections of orthopterous insects, the result of nine different explorations of the Galapagos Islands, have been examined by Mr. Samuel Scudder, and form the subject of a paper published in the Bull. Harv. Mus. Comp. Zool., Vol. XXV. The author notes the poverty of this Orthopteran fauna. In all there are but 25 species, of which 5 are cock-roaches, which can in no sense be considered endemic. The remaining 15 include 7 new species, and are all South and Central American in their affinities. A large proportion of the forms are incapable of flight, which can be accounted for only on the supposition that the Galapagos are of recent origin, and that the present Orthopteran fauna is derived from the chance advent of pregnant females from the nearest shore, or the shores which currents of the ocean practically make the nearest. The insect incapable of flight would stand the best chance of reaching the island, since it would have less inclination to leave its floating refuge, and thus the exceptional proportion of subapterous forms is explained.

An Axillary Pocket in Certain Chameleons.—In examining a collection of Reptiles sent from Madagascar to the Natural History

Museum of Paris, M. Mocquard discovered a pocket in the armpit of certain species of Chameleons, a character hitherto unnoticed. This pocket is formed by the invagination of the skin, and is about 4 mm. in depth, with an orifice of 2 mm. in diameter, varying slightly in size in different species.

This character appears to be constant in certain species only of Chameleons peculiar to Madagascar and the neighboring islands of Mauritius and Bourbon, for it does not appear in all of them, nor is it found in the Chameleons of the Continent, except in *C. vulgaris* in which a rudimentary pocket can be discerned. It is found also in *Rampheoleon spectrum*, a west African species, while not a trace of the character can be seen in *R. kerstenii*, which belongs on the eastern coast.

M. Mocquard considers this character of specific importance, and recommends its use in determining different species of Chameleons. (Compte-rendu Soc. Philom., Paris, July, 1893.)

The Origin of the Human Face.—In two short essays entitled The Origin and Evolution of the Human Face and Descent of Facial Expression, Dr. Alton H. Thompson gives a compilation of the literature of the subject with some original notes. His comments are intelligent and show a just appreciation of the idea of evolution. In the first essay the author keeps in view the point that the face and the brain were developed collaterally, and the high perfection of the face in man is due to his high brain development. The second essay is a contribution toward finding a scientific basis for the study of physiognomy and expression. Some of the varieties of feature of the human face are traced back to their animal origin, and the inheritance of emotional expression from the lower animals is touched upon. The essay is based on the facts of both phylogeny and ontogeny, and is an excellent synopsis of what has been written on the subject, to which several important original thoughts are added.

The Ground Squirrels of the Mississippi Valley.—In a paper recently published by the United States Department of Agriculture, Mr. Vernon Bailey describes the food habits and distribution of the five species of Spermophilus found in the Mississippi Valley. In addition, he summarizes the best methods of holding them in check, the preference being given to the use of bisulphide of carbon. The essay is handsomely illustrated. (Bull. No. 4, Div. Ornith. Mam. U. S. Dept. Agri., 1893.)

Zoological News.—Three new species of Annelids from the New Jersey coast are described and figured by Mr. J. P. Moore. *Clymnella elongata*, a tube dweller; *Eulalia lobulata*, so-called from the lobulated appearance of the peculiar tentacular appendages; and *Eracia bricornis*. (Contributions Zool. Lab. Univ. Penna., Vol. I, 1893.

In a report on the Aquatic Invertebrate Fauna of Wyoming and Montana, Mr. S. A. Forbes describes and figures several new species and varieties. The list comprises 5 Cladocera, 1 Ostracoda, 8 Copepoda, 2 Rotifera and 1 Protozoa. The investigation of this fauna was made with a view to stocking the lakes of Yellowstone Park with game-fishes. During the years 1890 and '91, 66 localities were visited, and the material gathered amounted to 460 collection numbers. (Bull. U. S. Fish Commissioners for 1891).

VERTEBRATA.—The Zool. Dept. of the Michigan Agri. Exp. Station has issued an illustrated list of the Birds of that State prepared by Mr. A. J. Cook. The author has adopted the arrangement of the Am. Ornith. Union, and has appended, in parenthesis, the number of the species as given in Coues' Key and Check-List. A résumé of the species show that the bird fauna of Michigan includes the Boreal, the Transition and the Sonoran. The large lakes attract many birds that are usually maritime, while the prairies and woodlands in the southern part of the State afford a habitat for the prairie birds and a long list of woodland warblers. All species of doubtful occurrence have been excluded from the list. So far as observation permits, the author has given the food habits of the species described. An extensive bibliography appended to the introduction adds to its value to the Ornithologist.

Mr. Gerrit S. Miller calls attention to the rediscovery of the gopher —*Thomomys bulbivorus*—at Beaverton, Oregon. This animal, described sixty years ago by Richardson under the name *Diplostoma bulbivorum*, has been entirely unknown to naturalists until the present day. (Proceeds. Biol. Soc. Wash., Aug., 1893).

EMBRYOLOGY.[1]

Frog Eggs under Pressure.—Professor G. Born[2] describes some interesting experiments made upon cleaving eggs of the frog. The eggs were subjected to pressure by confinement between glass plates that pressed upon the jelly about the egg and flattened out the egg itself so that its diameters were as 2 to 3 or even, in extreme cases, as 1 to 2.

The eggs were put between the plates before fertilization and could thus be arranged carefully with reference to the relative position of the main axis of the egg and the surface of pressure. Glass strips between the glass plates kept these apart a certain distance, say 1·4 mm.

Under these conditions cleavage takes place and the medullary folds may arise and even close over.

If the eggs stand in their normal vertical position—i. e., with the dark side uppermost and the horizontal plates press then thus in a direction parallel to the chief or vertical axis of the egg, the following departures from the normal cleavage take place.

The third cleavage is not, as normally would occur, by a horizontal furrow at right angles to the first and second furrows, but by two vertical furrows on either side of and parallel with the first furrow. The planes of the 1st, 2d and 3d cleavages are thus all at right angles to the pressing plates. This is true also of the 4th cleavage which is accomplished by two planes parallel to the 2d cleavage plane and at right angles to the first.

In such eggs, kept under pressure, the blastopore and subsequently the medullary folds appear upon the under side of the egg; the ventral part of the embryo is upward in these compressed, fixed eggs.

If the eggs are arranged so as to be squeezed from the sides, are compressed between plates parallel to the main axis of the egg, which stands vertically, then the following unusual cleavage phenomena are seen.

The first plane being as usual vertical, is also at right angles to the pressing plates; the second is not vertical as normally would be the case, but horizontal. The third cleavage is often expressed by two planes parallel to the first, while the fourth may be parallel to the second.

[1] Edited by Dr. E. A. Andrews, Baltimore, Md.

[2] Anatomischer Anzeiger, VIII, Aug. 5, '93, pps. 609–627.

These departures from the normal might be due to the direct effect of the pressure acting upon the dividing nuclei or else to the secondary effects brought about through the change of form the egg suffers under the pressure.

While Pflüger was inclined to regard the pressure as acting directly, as determining the direction in which the nucleus could most easily elongate, the author thinks that the change of form of the protoplasm is the determining cause of the new arrangement of the cleavage planes. He thinks that these phenomena may be brought under the rule formulated by O. Hertwig, that in dividing the nucleus tends to get into the center of its field of action, the surrounding protoplasmic mass, and places itself so that its poles are toward the largest masses of protoplasm.

It is thus not the pressure which directly alters the position of the nuclear spindle but the forced change of form of the protoplasm of the cell which necessitates an adjusted position of nucleus and hence a subsequent change in the direction of the cleavage.

If the author succeeds in making out in detail this mass effect of these distorted cells we would seem to have additional reason for regarding the nucleus as of less value than the protoplasm in the determination of form.

Embryology of Chiton.—Dr. M. M. Metcalf studied the embryology of *Chiton marmoratus* and *C. squamosus* at Jamaica, where the Marine Laboratory of the Johns Hopkins University was located in 1891. An account of the breeding habits, methods of studying the small opaque eggs (use of hardening liquids, hypochlorite of soda to remove the chorion and yolk, etc.) and a detailed, illustrated description of the cleavage and gastrulation is given in the last number of the Studies of the Biological Laboratory, Baltimore, October, 1893.

The eggs were obtained from specimens kept in aquaria; both eggs and sperm are discharged for a period of two hours or more after a time of active, sexual excitement. The males and females, however, do not approach one another but seem to give off the sexual cells under the stimulus of some unknown influence.

The cleavage is described and figured in great detail chiefly from surface views of living eggs, and from reconstruction of sections up to the forty cell stage. The gastrulation also is given in detail and presents interesting features with reference to the slit like form of the blastopore in Peripatus. Later stages are reserved for subsequent work. In general the results here given confirm the work of Kowalevsky.

Lithium Monsters.—Curt Herbst[3] has continued his work[4] upon the action of salts upon echinoderm larvæ and publishes a full account, with careful figures, of the various abnormal or monstrous larval forms produced by the action of very dilute solutions of lithium chlorid.

Both Sphærechinus and Echinus give results though Asterius, and presumably other animals, act differently or not at all under the influence of this salt.

The eggs are fertilized and then put into sea water containing 2½% of the lithium solution. This solution itself is, however, very weak, only 3·8 g Li Cl to 100 cm hydrant water.

The blastulas that arise from these eggs have thick walls with the inner end of their cells much vacuolated at first, but as they enlarge become elongated vesicles with thin walls. This vesicle becomes constricted into two, more or less separate; one has a thicker wall and long cilia, the other a thinner wall and short cilia. Between the two an intermediate, connecting vesicle may subsequently be interpolated.

Now it is evident that one of the vesicles, the one with thin cells of long cilia represents the ectodermal part and the other vesicle, the thick walled one, the entodermal part of a gastrula turned inside out; for there are all transition stages between these double vesicles and what the author calls exogastrulæ. These are evidently gastrulas in which the entodermal tube protrudes as a closed, thick walled process just as would be formed if the entoderm grew outward instead of inward as normally happens.

Invagination being due to a rapid growth of a zone of cells on the vegetative side of the blastula we need but have the direction of growth changed, by the lithium salt, to produce such an exogastrula. If this zone of growth extend, under the influence of the salt, more and more over the vegetative side of the blastula there will result a more typical lithium larvæ, or stages between it and the exogastrula. Finally some cases arise in which it seems that this zone extends all over the blastula; such larvæ are mere single vesicles of entoderm! There is thus a conversion of what would normally form outside and inside, ectoderm and entoderm, of the gastrula, into what may be styled entoderm only.

The author thus agrees with Driesch in regarding the cells of the early larvæ as omnipotent in their capabilities; they may become

[3]Mitth. Zool. Sta. Neapel. II.

[4]See AMERICAN NATURALIST, March, 1893.

ectoderm or entoderm; the idioplasm is not early divided qualitatively amongst the cells as Raux and as Weismann maintain. This same lack of differentiation is shown, the author holds, by certain other abnormalities sometimes produced when the embryos are subject to the action of lithium. Thus larvæ may be reared in which the arms and ciliated band are formed in abnormal places, from cells, apparently, which would not normally form such structures at all, i. e., cells have been induced to form what they would not be able to form were they really specialized.

From the wealth of observation upon the action of lithium at different stages of larval life exposed for different periods to this action we can select only one of the interesting facts that result, namely, that the action of this salt does not cease when the egg is removed from the salt into pure sea water. Under some conditions such eggs may continue to develop along the abnormal direction or may begin to form lithium larvæ, though as far as can be seen they are perfectly normal when removed from the salt into the sea water. Such facts militate against the author's former assumption of the direct action of these salts in modifying the osmotic penetrability of the egg protoplasm and show that the action is a more subtle, unknown one.

The author argues that the entoderm cells of the blastula have the property of taking up and holding the lithium salt to a greater extent than do the ectoderm cells. In some unknown way this is connected with their unusual mode of growth.

It is important to note that the eggs of different individuals react to quite different extents, different degrees, to the stimulus produced by the same amount of the lithium salt.

Mechanics of Embryology.—Hans Driesch[5] adds four more chapters to his six previous contributions to this subject.

The first treats of the results obtained when the eggs of Sphærechinus are put, about twenty-six hours after fertilization, into water that is kept for eighteen hours in a warm chamber heated at 30° C.

The larvæ that result are blastulas with a protruding tube on one side; in fact the increased temperature has brought about the same result as Herbst obtained by the use of lithium salt, the gastrulations begin in an inverted sense, the entoderm grows outward instead of inward. Such *exogastrulæ* when removed to cooler water continue to live and may form plutei with long entodermal tubes attached; in each case the entodermal tube, or more properly closed pouch, is divided

[5]Mitth. Zool. Station Neapel II. 1893.

into three regions as it would be if it grew inside the ectodermal vesicle or body wall.

The entodermal tract remains small—does not swell out as in the lithium larvæ—and ultimately shrinks and falls off.

In this way *anenteria* are formed, or plutei having no entoderm. Yet in these there is formed a small oral invagination without the presence of the entoderm. Such *anenteria* lived a week, but did not regenerate the digestive tract.

The second chapter deals with the effects produced by water containing less than the normal percentage of salts. Eggs of Echinus as soon as fertilized, are put into sea water to which fresh water has been added in the proportion of 45·5; after five minutes they are transferred to 40·10 and then 35·15 and so on to 25·25.

The eggs swell, cleave normally in 45·5 but abnormally in 40·10 and 35·15; while in 30·20 only the nuclei divide; in weaker solutions the eggs die. The abnormal cleavage above mentioned consists in the unequal size of the cells formed in the eight cell stage. Here there are 2 to 4 cells so small that they may be called micromeres. In the weaker solution, 35·15, there is added the shifting of the cells into a tetrahedral arrangement not otherwise present.

Having thus produced apparent micromeres by varying the percentage of salts in the sea water, the author regards the normal micromeres as not essentially different from the macromeres in their nuclei or idioplastic parts, but as merely a result of the activity of the protoplasm; protoplasm may be effected by external agencies so as to make micromeres when they are not predetermined by any character of the nuclei.

The third section takes up his previous conclusions as to the interchangeableness of the ectoderm and entoderm in their beginning. Not satisfied with the facts formerly relied upon to show that what would be ectoderm cells could form entoderm and vice versa, attempts were made to determine the relation between the position of the micromeres and the place of origin of the entodermal invagination. But the experiment failed, since the eggs revolved in the capillary tubes in which they were reared and so made conclusions invalid. A second series of experiments was successful in showing the independence of micromeres and entoderm and also in demonstrating that cells normally destined to form the vegetative side of a blastula could form a complete larvæ, while cells that should have formed the other half of the blastula could also form a complete larvæ.

These experiments consisted in shaking off one or the other sets of

cells in the sixteen cell stage, after the egg membrane had been removed. At this stage there are eight equal cells, of the vegetative region, four large cells and four micromeres of the animal region. Complete pleuti arise when the micromeres are absent; when only some of the above 8 negative cells are present.

The facts in connection with the author's previous experiments upon compressed eggs show, he thinks, that the nuclei of a cleaving egg are equivalent and that the germ layers are not separated during cleavage by any qualitative nuclear divisions.

The presence of micromeres is shown to be unnecessary for the formation of an echinus gastrula.

(Some attempts to form fusions of cleaving eggs are mentioned here, though they were not successful; the eggs adhered (after treatment with chloroform) but eventually separated again).

The last chapter deals with some fundamental questions and results reached by this mode of investigation.

The outcome of all the author's work is in opposition to the views held by Roux and Weismann, for it is shown that the cleaving egg, at least in these echinoderms, is not differentiated as regards its nuclei which are all alike in quality. Not so the protoplasm of the eggs which the author maintains must be anisotropic from the first, must possess a differentiation in direction so that all of it, or a part of it when removed, acts like a stimulus in producing the first differentiation of form, which is the first difference between the ends of the main axis of the larvæ. When the larva becomes bilateral this is due to a like direct specialization in the protoplasm, finding its expression in the difference seen between the dorsal and ventral sides of the larvæ.

Some organs may owe their position directly to this determined axial condition, others may arise from more indirect causes, from stimul- that come either from other separate organs or from without the organi ism.

Cells become this or that according to their position; the organs arise as functions of the positions of the cells forming these organs. Thus is the peculiar half-dead embryo Roux obtained in the case of the frog; the cells are forced to remain in their original or normal positions by the presence of the dead half-embryo; if this were away the cells could rearrange themselves and so coming into new positions would form one complete embryo, not a half embryo.

The evolution of form in an individual is the result of stimuli and reactions of a complex interacting nature. These only are investigated in "entwicklungsmechanische studien." The primal origin of form

lies in the ovum; the ontogeny is not true epigenesis but rather an evolution, since the protoplasm at the first has a tendency toward direction, is an-isotropic; this initiates the subsequent actions and interactions of parts.

This branch of biological study thus leads back only to something having determined form, not to a physicochemical starting point; the problems of morphology are not physicochemical problems.

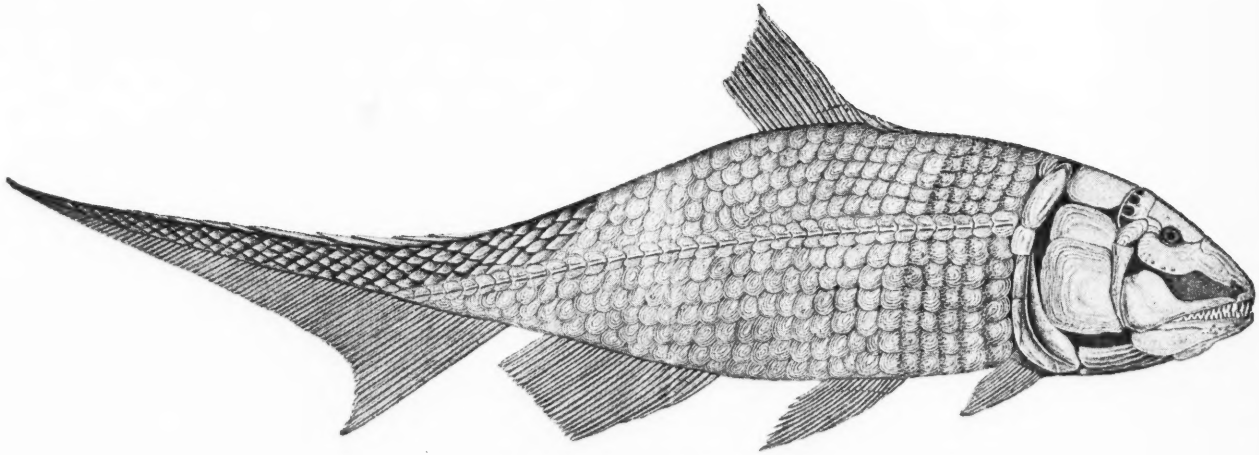
ENTOMOLOGY.[1]

Lycænid larva on Atriplex.—On July 6, 1892, I beat several small lycænid larvæ from *Atriplex canescens*, 12 miles north of Cedar Ranch, Arizona, on the stage road from Flagstaff to the Grand Cañon. The larvæ were of almost the same shade of color as the bush and leaves, of a very light whitish-green, thus easily escaping detection. If I am not mistaken they fed on the underside of the leaves.

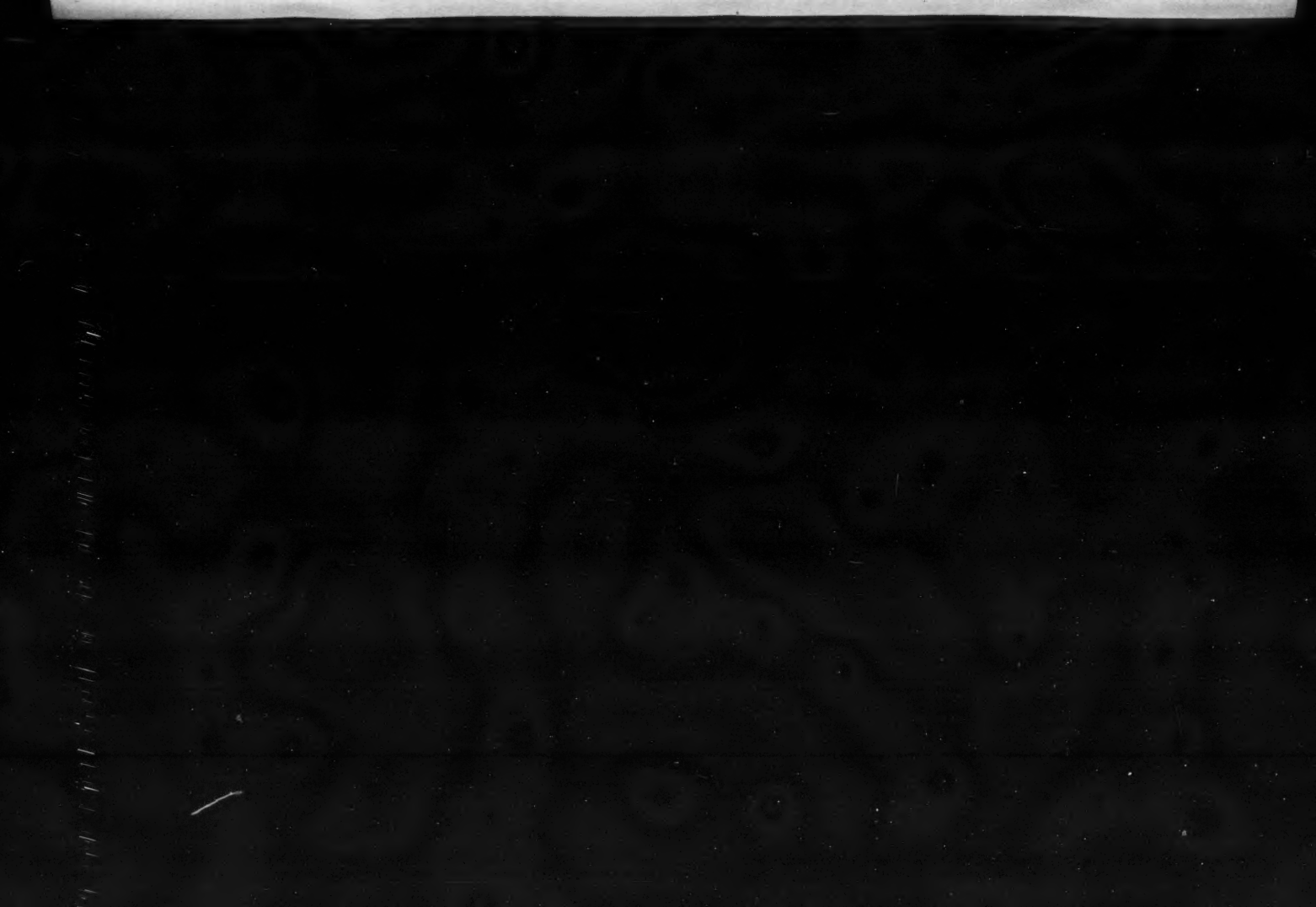
Description of larva.—Length (in strongly curved position), 5 mm.; width, 2½ mm. Thirteen jointed, strongly curved (after immersion in alcohol), arched, broad, somewhat flattened, tapering to head, more rounded posteriorly. In color pale whitish-green, head shining jet black; a median dorsal, and two lateral rows (one on each side) of reddish spots, one spot to each segment, on segments 3 to 10; those on anterior segments much fainter usually, especially the lateral ones. Often a faint row of smaller spots ventrad of the lateral row. Head very small compared with other segments, hardly more than one-third the width of the prothoracic segment, within which it is usually retracted; subhemispherical in shape, convex dorsally, glabrous, well polished and shining. All the other segments thickly covered with minute short white spine-like tubercles, with a less number of similar black ones interspersed. These extend on the ventral portion, which is besides clothed with some short whitish hairs along sides and on prolegs. The anterior portion of dorsum of prothoracic segment is furnished with more numerous and larger short and stout black spines. Prothoracic segment subtriangular in outline from above, a little rounded in front, widening behind; segments 3 to 6 widening posteriorly, each wider than its predecessor; segments 7 to 10 about equal in width, a little wider than 6; 11 and 12 gradually narrowing from 10; 13 considerably narrower than 12 (in some specimens regularly narrowing from 12), rounded posteriorly, with a terminal somewhat narrower and partially free joint which bears the terminal or anal pair of prolegs. Segments 3 to 8 each gathered into a transverse, slightly curved, more or less hump-like ridge on dorsum, the prothoracic segment with a strongly anteriorly bent one, segments 9 to 11 hardly humped, segments 5 to 8 usually most strongly so. Eyes represented by five small glassy simple eyes, four of them arranged in a semicircle with the outside antero-dorsad, the fifth postero-ventrad of the four. Mandibles minute,

[1]Edited by Prof. Clarence M. Weed, New Hampshire College, Durham, N. H.

PLATE XXX.



Trissolepis kounoviensis Fritsch.



7-toothed (6-notched) on the very broadened and circular apical margin, brownish. Other trophi light colored. Spiracles somewhat raised, situated on side posteriorly of prothoracic segment, and on sides of segments 5 to 12, those on 11 and 12 situated higher up on dorsum and more removed from the lateral margin. Three pairs of short hook-like true or thoracic legs; and five pairs of fleshy prolegs, on segments 7 to 10 and terminal joint of 13.

Note.—The segment which is called a terminal joint of segment 13 may perhaps be regarded as the thirteenth segment. In this case the slightly hood-like or flap-like portion which projects over it from the twelfth segment would necessarily be regarded as a posterior development of that segment.

Described from 3 specimens. Color noted in life. Arizona. The special organs described by Mr. W. H. Edwards, in his second volume of the Butterflies of North America, as found on segments 11 and 12 of the larva of *Lycæna pseudargiolus*, are also present in the above larvæ on *Atriplex*. The median transverse opening on 11 is very plain, but the two retracted tubes on 12 do not show as plainly as figured by Mr. Edwards. These latter show very much more plainly in lycænid larvæ which I have taken in southern New Mexico on mesquite in May. —C. H. Tyler Townsend.

Honey Adulterations.—There has been in the past much difference of opinion among chemists and beekeepers concerning the detection of honey adulterations by chemical methods. To obtain more definite information on the subject Professor A. J. Cook recently had samples of a large number of kinds of honey analyzed by Professor H. W. Wiley of the U. S. Department of Agriculture, Professor R. C. Kedzie of the Michigan Agricultural College, and Professor M. A. Scovell of the Kentucky Agricultural Experiment Station. The results of these analyses are published in Bulletin 96 of the Michigan Station, and from them Professor Cook draws these conclusions:

1. That chemists can easily detect adulteration of honey by use of glucose, in all cases where it is likely to be practiced. The same would be true if cane sugar syrup were mixed with the honey.

2. That a probable method to distinguish honey dew honey from honey adulterated with glucose has been determined by these analyses. The right-handed or slight left-handed rotation together with the large amount of ash, and small amount of invert sugar indicate honey dew honey. As honey dew honey will never be put onto the market, this question is of scientific rather than practical importance.

3. As yet the chemist is unable to distinguish between cane suga syrup honey—by which we mean cane sugar syrup fed to the bees andr transformed by them into honey, and not cane syrup mixed with honey, which is adulteration pure and simple, though a kind not likely to be practiced—and honey from flowers. As the best cultivated taste cannot thus distinguish, this seems of slight importance. If it should prove to be important to be able to distinguish them it is probable that the chemist will discover the means, as chemistry has very delicate eyes, and can usually search out very slight differences.

North American Noctuidæ.—Professor Smith has furnished a striking example of his industry as a student of the Noctuidæ in his recent catalogue[2] covering 424 pages, which are nearly all devoted to the catalogue proper. The preface consists of a statement of the collections in America and Europe examined by the author, with explanations of the methods adopted in preparing the catalogue. This is followed by an index of authors and works cited, and the bulletin closes with a very complete index in which every name used in the body of the bulletin is included. This index covers 25 double-column pages in small type which will give some idea of the extent of the family and the completeness of the catalogue.

Recent Bulletins.—The entomologists of the experiment stations continue active in issuing publications concerning injurious insects. The subjects chosen cover a wide range, and while much of the matter consists of a republication of existing information—a legitimate function of the stations—a good deal of original knowledge is being brought out. In Bulletin, 32 of the West Virginia Station, Mr. A. D. Hopkins presents a catalogue of the Forest and Shade tree insects of that State. The list includes 494 species, only a part of them, however, being injurious, the others being parasitic or predaceous, or living under the bark of fallen logs. Mr. Hopkins has paid special attention to the Scalytidæ and is accomplishing valuable results in their study.

In Bulletin No. 24 of the Colorado Station Professor C. P. Gillette treats of "A few Common Insect Pests." The species discussed are enemies of cabbages, onions and other garden crops. A Thrips, doubtfully identified as *T. striatus* Osborn is reported to do serious injury to onions.

[2] A catalogue, bibliographical and synonymical, of the species of moths of the Lepidopterous superfamily Noctuidæ found in Boreal America. With critical notes, by John B. Smith, Sc. D., Bull. U. S. Nat. Museum, No. 44.

In Bulletin 98 of the Michigan Station Mr. G. C. Davis briefly discusses locusts (*Acrididæ*) and the Horn Fly (*Hæmatobia serrata*), while in Bulletin 96 of the same Station Professor A. J. Cook discusses Honey Analyses.

Professor J. B. Smith has recently sent out two bulletins from New Jersey. In No. 95 he announces that Brood XII of the Periodical Cicada is due in New Jersey next year, and is likely to appear all over the state, though more abundantly in the northern and eastern counties. He suggests that no pruning or budding be done this fall or next spring, leaving abundance of surface for oviposition. This is an excellent example of the value of entomological prognostication.

Bulletin 94 discusses "Insects injurious to Cucurbs" in a practical way that is sure to be appreciated by New Jersey farmers.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Natural Science Association of Staten Island.—June 10, 1893.—Mr. Wm. T. Davis exhibited specimens of *Iva frutescens* and read the following paper upon "The Influence of the Past Winter on the High-Water Shrub."

An examination of the High-Water Shrubs, (*Iva frutescens*,) during the past few days, has disclosed an interesting fact, which is no doubt entirely due to the severe weather of the past winter. A glance along the meadow creeks show, as yet, but a gray line of bushes with numerous short sprouts starting either at their roots or a few inches above them on last year's wood. On the 7th of May, 1892, while observing the sea-side finches, the High-Water Shrubs were noticed to be coming into leaf midway up the stems, and by the middle of May it was difficult to secure a good view of the finches owing to the number of leaves. This year there would be no difficulty, for even at this date they are as bare as in the winter, having retained their vitality for only five or six inches above the ground. Some of the dead *Iva* stems show evidence of being three or four years old, so there is this proof also that the past winter has been the hardest one for the species during at least that length of time.

Mr. Davis also read the following: "Local Notes upon the Opossum and Red Fox."

The opossum visitation, which was commented upon in these Proceedings for March 12, 1892, has in no wise abated, and during the past year quite a number were killed on the island.

No less than fourteen opossums have been taken at Watchogue and the neighboring hamlets within a short period. It was thought by the residents, that they were possibly imported on the railroad, as the completion of the bridge and the appearance of the opossums were so nearly coincident. However, the causes given in the Proceedings referred to above, are probably the correct ones. In the winter of 1891–92, a dog owned by Mr. George Marsac, who lives at Watchogue, caught two opossums, one of them under the piazza floor. This past winter, Mr. Marsac and Mr. John De Bau found four opossums in a hollow gum tree; Mr. George Decker and Mr. Marsac caught two others, and Mr. Orville Merrill, one; Mr. George Merrill, one; Mr. Smith one in his cellar, and Mr. Van Pelt, who lives near Bull's Head, found one in his chicken house. Mr. Drake, of Old Place, heard a disturbance in his

chicken house last summer, and discovered, upon investigation, an opossum, which he promptly killed. On April 30, 1892, I found a very much decayed opossum in the woods near Watchogue, and even under such circumstances it had the peculiar fatty odor for which the animal is remarkable.

Mr. Gratacap has informed me of an opossum captured on Bement Avenue, West New Brighton, and Mr. Galloway, of one killed on the Leonard White place, in Middletown. One was secured on the Mc Andrew place last winter ; one on the Meissner place at Richmond by Mr. Lyle, and one in the Moravian Cemetery by Mr. Albert.

This spring, Mr. Samuel Henshaw showed me a dead opossum under an apple tree near the brook that crosses the Manor Road ; Mr. Joseph C. Thompson found one near Arrochar, and Mr. Perry Cornell, on the 9th of April, caught a twelve pounder in the old iron ore mines on the slope of Todt Hill.

From the above facts and those presented in the Proceedings of March 12, 1892, it appears that the opossum has become well established on our Island, and that thirty-six individuals have been captured during the last four years. Of course, the record can only be considered as partly complete.

In connection with the opossum visitation, it may be well to record a few memoranda concerning the foxes that have been found on the island within the last few years. In 1887 or '88, one was killed by Mr. Cole, who resides on the Amboy Road, near Oakwood. It was believed at the time to be the individual that escaped from the superintendent of the railroad. In July, 1890, the *Richmond County Standard* printed an account of the foxes that had been killed or seen in the vicinity of Richmond. It was believed that the original pair either escaped from the hunters of the Country Club, or from the captain of a canal boat, which had several on board, while discharging his cargo of coal at Richmond Creek. The animals destroyed many fowls on the Dedker and Latourette farms, and on the former of these places a young fox was trapped, the jaws holding him by the toes. In the morning, it was found that his mother had evidently been busy all night, as his shoulders were lacerated by her efforts to secure his release. Another fox was shot by Mr. Decker, while it was killing a Guinea hen.

Last summer, Mr. Freemans of Old Place, was on the meadows near his home engaged with some companions in surveying, when they discovered a family of foxes beneath a hay stack. The male ran away upon the approach of danger, but the mother and five young were finally secured.

The following paper, by Mr. Arthur Hollick, in the absence of the writer, was read by the title "Notes on the Geology of the New Railroad Cut at Arrochar."

In a previous contribution on the Cretaceous formation of Staten Island, (Proc. Nat. Sci. Assn. S. I., Jan. 9, 1892), I mentioned the discovery of Cretaceous fossils at Arrochar, and called special attention to specimens of *Cardium dumosum* Conrad, which were found in a seam or stratum of sandy clay, which I was inclined to think might repre sent the outcrop of more extensive strata not far below. Recent exca vations for a new railroad cut in the vicinity led me to hope that the overlying Drift deposits might be penetrated to a sufficient depth to expose these strata, which, from the surface indications, we know can not be very far away. Several visits were made while the work was in progress, but it was not until last week that the excavation was completed and, fortunately for the geologist, the heavy rain of the 6th inst. followed immediately afterward and washed everything clean in a most gratifying manner, affording unusually favorable conditions for final observation during the past few days.

At the base are masses or beds of bluish, semi-plastic and sandy clay, from which extend upward irregular seams and smaller masses, interbedded with fine sands and gravels, in which "flow and plunge" structure is generally well marked. This series of deposits reaches the surface at about where the new Arrochar station is located, and from thence southward are all that is to be seen. The bowlder till thins out to a feather edge where the sands and clays come to the surface and gradually become thicker northward, until finally it is all that is visible in the cut. The deepest part of the cut shows the entire series from base to summit and give us a 50 foot section in a N. and S. direction, through the extreme edge of the terminal moraine. Irregular masses of clay, accompanied by water-assorted sands and gravels at the base capped by the unassorted bowlder till on top. The thickening of the bowlder till northward and the position of the underlying materal give a general appearance of north to northwestward dip for the entire series.

No positive evidence of any Cretaceous strata in place could be found, but on the other hand a large part of the sands and gravels are manifestly reassorted Cretaceous material. The characteristic ferruginous sandy clay concretions in which most of our Cretaceous fossils have been found are abundant, and the sandy clay stratum in which the *Cardiums* previously mentioned were found, may be traced into the cut, with its accompanying sands and gravels. It can no longer be

regarded as an outcrop, as other similar seams or masses are quite prominent, interbedded with the sands and gravels. In some places coarse gravel and clay nodules are so cemented together with limonite that a firm conglomerate is formed. Iron is everywhere abundant. In some hand specimens of the conglomerate may be seen pyrite, magnetite and limonite and spring waters are impregnated with the sulphate. Acc tic iron sand may also been seen in places. Yellow Gravel or Pre-Glacial Drift is also, to a limited extent, a constitutent of the assorted material.

It is evident that only the upper part of the clay has been reached and this is very much disturbed and crumpled, portions having been torn off from the main mass below, forming the irregular beds or seams associated with the sands and gravels. The indications are that these were all deposited previous to the advent of the glacier which shoved them ahead and finally left them overlapped by the thin edge and flanked on the north by the mass of the bowlder till.

The character of the clay is not that of our ordinary bowlder clay, which is nearly always colored red from the prevailing constitutent—eroded Triassic sandstone and shale. These clays are bluish and the rock from which they were formed is not anywhere in evidence at the present time. The large amount of mica and the occasional fragments of mica schist, hornblende schist and granite which are to be found throughout all the underlying deposits at Arrochar may perhaps be accounted for on the theory of a belt of such rocks to the south and east of the serpentine ridge which has suffered decomposition and erosion and thus formed the source of supply for the bluish clay and micaceous fragments. Such a belt is theoretically present, for we know that it exists to the east of the serpentine at Tompkinsville and St. George. This theory is emphasized by the position of the clay which is beneath and older than the bowlder till and would thus have been formed independent of material from the red Triassic area which did not suffer extensive erosion until it had been overridden by the glacier. One lenticular basin of clay in the upper part of the till north of the moraı nal edge, deserves attention from the fact that the clay there formed is typical reddish bowlder clay, horizontally stratified and evidently undisturbed since its deposition, which must have been subsequent to the retreat of the glacier. This was the source from which the erstwhile brick yard at Arrochar obtained its material for the manufacture of building brick. The comparison between this red, horizontally stratified clay in the till above, and the bluish distorted masses beneath is striking.

One feature that will doubtless be noticed at once by everyone who examines the material in the moraine at Arrochar, is the quantity of soapstone and limonite ore contained in it, evidently due to the erosion of the serpentine ridge which near this point was crossed by the glacier.

Summarizing the results of our facts and observations we may picture to ourselves the former coastal plain, consisting of Cretaceous and later deposits, extending to the base of the serpentine ridge, with a belt of schistose or gneissic rocks around its base. On the advent of the glacier, advancing from the northwest these deposits were eroded and pushed ahead by the ice mass and assorted by the torrents which flowed from it, and which, on its retreat, left the deposits of the till, forming a superficial unassorted cap, composed of fragments of rocks from the north, in which the Triassic sandstones, shales and traps of New Jersey are the most abundant constituents. In the depressions of the till, local deposits of gravel, sand and clay would accumulate, colored with the prevailing red from the eroded Triassic rocks.

September, 9.—Dr. N. L. Britton showed a specimen of *Agrimonia mollis* as an addition to the flora of the Island. This and the commoner *A. striata*, have been included in manuals under *A. eupatoria* which is, however, a European species.

Mr. Arthur Hollick presented a piece of Triassic sandstone, found in the Drift at Arrochar, by Miss Grace Hollick, on which were casts of a plant stem.

Although Triassic shale and sandstone were among the most abundant of our Drift material this is the first specimen in which we have been able to identify any indication of a fossil. A carefully prepared drawing was submitted to Professor Lester F. Ward, palæobotanist of the U. S. Geological Survey, and was by him submitted to Professor Wm. M. Fontaine, who concluded that it was probably *Equisetum rogersi* Schimp. If so this is not only an interesting addition to our list of Drift fossils but is of interest also on account of its rarity in the Triassic of New Jersey, from whence it must have been derived. So far as I know New Milford is the only locality in New Jersey from which it has been reported.

Mr. Wm. T. Davis read the following miscellaneous memoranda and exhibited the specimens mentioned.

During the past summer the Periwinkle (*Littorina litorea*) has been found in some numbers alive on the shore at the Narrows, and also on the rocks at Princes Bay. In these Proceedings for January 14, 1888, Mr. Sanderson Smith, upon the finding of an empty shell at the Nar-

rows by Mr. Hollick, gave an account of the southward migration of the species along the Atlantic Coast, noting its occurrence on Long Island, etc. This is the first record of its being found alive on our Island.

Mr. Leng recently collected in Augur Lake, near Keeseville, N. Y., a rare *Dytiscus* beetle, probably *D. harrisii*, which he brought home alive in a tin can as his alcohol bottle was not sufficiently large. Upon opening the can for the inspection of the insect, we were pleased to find a dark brown *Gordius* worm of unusual size. After carefully untwisting and unkotting the tangled creature, which took our united efforts, we measured it with a rule, and discovered that it was twenty-eight inches long. In Dr. Packard's zoology it is stated that hair-worms "live in ground-beetles and locusts," twisting around the intestines of their hosts.

The severe storms of the 24th and 29th of August blew many green hickory nuts from the trees, and in spite of their unripe condition the shell-bark nuts were promptly devoured by gray squirrels. Under one of the trees on Richmond Hill, there were many quarts of the outer green husks gnawed fine, and of the nuts from which the kernel had been extracted after the outer bitter covering had been wholly or in part removed. It appears from this that it is probably the firmness of their attachment to the end of the tree branches, and not their green husks, that prevent the unripe hickory nuts from often being eaten by squirrels.

This morning a green example of the walking-stick insect (*Diapheromera femorata*) was found in the Clove Lake swamp on a golden rod. Though common northward, in the Hudson River valley, it is rare with us, and this is only the fifth recorded specimen from our Island.

Mr. Davis also exhibited some exotic water plants that had been introduced by some person of an experimental turn into one of the numerous small ponds in the woods north of the Moravian Cemetery. Among them was the Chillian Mermaid-weed, the South American Pond weed (*Eichornia crassipes*), a lily and one of the sedges, all of which seem to do well among the native plants.

Boston Society of Natural History.—November 1st.—The following paper was read:

Professor George Lincoln Goodale, "On the cultivation of Tea, Coffee and Cacao. Illustrated by stereopticon views of plantations in Ceylon and Java.—SAMUEL HENSHAW, *Secretary.*

The Biological Society of Washington.—October 21. The following communications were read:

Professor Lester F. Ward, "Weismann's Concessions." Doctor C. Hart Merriam, "Notes on a Biological Reconnoisance of Wyoming." Mr. Vernon Bailey.

November 4th.—The following communications were read:

Mr. W. T. Swingle, "Some Problems of Plant Geography in Florida." Doctor C. Hart Merriam, "Fauna and Flora of Eastern Wyoming." Doctor C. W. Stiles, "Artificial Species of Cestodes." Professor Lester F. Ward, "Cycadean Trunks in the American Cretaceous."—FREDERIC A. LUCAS, *Secretary.*

NATIONAL ACADEMY OF SCIENCE.—The following papers were entered to be read at the meeting held at Albany, N. Y., November 7th, 1893.—I. American Palæozoic Cockroaches, Samuel H. Scudder. II. Additional Researches on the Motion of the Earth's Pole, Seth C. Chandler. III. Biographical Memoir of A. H. Worthen, C. A. White IV. Biographical Memoir of W. P. Towbridge, C. B. Comstock. V. The Geological Map of the State of New York, James Hall. VI. On a new form of Telescopic Objective, as applied to the twelve-inch Equatorial of the Dudley Observatory, Charles S. Hastings. VII. On the Structure and Development of Trilobites, Charles E. Beecher, (Introduced by A. Hyatt.) VIII. Double Stars, Asaph Hall. IX. Latitude Determinations at the Sayre Observatory, Charles L. Doolittle, (Introduced by Lewis Boss.) X. Insect Voices, Joseph A. Lintner, (Introduced by James Hall.) XI. Edible and Poisonous Fungi, Charles H. Peck, (Introduced by James Hall.) XII. A New Process of Printing in Color, Edward S. Morse. XIII. On Reaction—Times and the Velocity of the Nervous Impulse, J. McKeen Cattell and Charles S. Dolley, (Introduced by G. F. Barker.) XIV. The Palæontology of the State of New York; the present condition of the work, James Hall. XV. Certain Histological Relations Between the Subalpine Plants of the White Hills and of the Labrador Coast, George Lincoln Goodale.

A special stated session of the Academy took place on Wednesday, November 8th, in Albany, to consider the President's Annual Report to Congress, and other business.

The new Dudley Observatory was dedicated. Prof. Newcomb made the speech for astronomy and there were other speeches by Mr. Lansing and Bishop Doane, Gen. Rathbone was master of ceremonies.

SCIENTIFIC NEWS.

The Natural History Society of Dantzic offers a prize of 1250 francs for the best essay on the most efficacious means of destroying the poisonous insects in the forests of western Prussia. The essays must be written in German or French and be sent to the Society before the end of 1898.

Professor Loew, of Munich, has been elected to the chair of Chemical Argriculture in the University of Tokio. Professor Loew is well known from his researches on the nature of protoplasm.

Dr. H. Möller has been appointed Professor of Botany in the University of Greifswald.

An exploring and surveying expedition has been organized in Brazil to study the less known parts of the Amazon basin and to collect information as to ethnography and natural history. The expedition was intended to leave Santos in August, and cross the plateau of Matto-Grosso towards the upper waters of the Amazon, where surveys and scientific collections will be made.

The California Academy of Sciences has published a bibliography of the Paleozoic Crustacea, prepared by Mr. A. W. Vogdes. Besides the list of authors there is an index of the species described in each work. The literature ranges from 1698 to 1892.

Erratum.—Through an oversight on the part of the engraver the figures (Plates XIX–XX) accompanying the paper on "Eggs of Pityophis melanoleucus," in the October NATURALIST, were reduced one-quarter, while the accompanying legends were printed as in the original copy. The error neeessitates the substitution of the following for the table of explanations on page 885, and corresponding corrections in the legend subscribed to each figure.

EXPLANATIONS OF PLATES XIX, XX.

Pityophis melanoleucus.

Fig. 1—Cluster of seven eggs represented as they naturally cohere. a—point at which an eighth egg was attached.; ¾ natural size.

Fig. 2—Surface cracking of the calcareous crust—from an equatorial region; x 7½.

Fig. 3—Vertical section of a small portion of the egg shell showing a small part of five laminæ; x 600.

Fig. 4—Several fibres of different sizes after being dried and mounted in glycerin. The lumens are filled with air; x 600.

Ftg. 5—Surface view of a small portion of a lamina; x 127.

Fig. 6—A few isolated fibres. x 375.

Fig. 7-8—Two views of embryos in their natural positions on the yolk; ¾ natural size.

Fig. 9—Left side of head of an embryo showing the scutes. x 5¼; p. 881.

Fig. 10—Dorsal view of the same; x 5¼; p. 881.

Fig. 11—Anal plate and hemi penes of a male; x 6.

Fig. 12—Same region of a female; a—rudimentary hemi penes; x 6.

Fig. 13—Lateral (external) view of a hemipenis; x 5¼.